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FIRST ANNUAL REPORT

OF THE

DIRECTOR OF THE AGRICULTURAL DEPARTMENT,

BENGAL.

Calcutta:
BENGAL SECRETARIAT PRESS.
1886.

PART I.

THE ANNUAL REPORT.

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No. 510*T.*

FROM M. FINUCANE, ESQ.,

Director of the Agricultural Department, Bengal,

TO THE SECRETARY TO THE GOVERNMENT OF BENGAL,

REVENUE DEPARTMENT

Dated Calcutta, the 15th October
Issued Darjeeling, the 19th October } 1886.

SIR,

I HAVE the honour to submit a report of the operations of the Agricultural Department in Bengal for the year 1885-86. The report extends over a period of seventeen months, from May 2nd, 1885, when the Department was created by Government resolution of that date, to the end of July 1886, and deals, not only with the duties which I have discharged under the immediate orders of Government, but with questions such as that of the organization and maintenance of village records, as regards which I have acted in subordination to the Board of Revenue. I have included these latter matters in this report both in accordance with the practice followed in the North-Western Provinces and elsewhere, and with the orders of the Government of India, conveyed in their No. 54 of the 28th April 1884.

2. For the clearer comprehension of the scope and character of the work done or attempted by the Agricultural Department in Bengal, which in certain respects differs from that of similar departments in other provinces, it is necessary to trace the history of the institution of the department in these provinces.

Summary of the history of the creation of the Agricultural Department in Bengal.

3. Passing over the early history of Agricultural Departments under Lord Mayo's administration in 1870, it will be remembered that the idea of the direct intervention of Government in agricultural progress and reform in India was revived in 1881, in consequence of the report of the Famine Commissioners.

Struck with the absence of proper means of collecting reliable information in times of prosperity, on which the action which adverse times require might be based, the Famine Commission made certain recommendations, for the organization of an agency, for the collection of such information. Looking at the condition of the country from two points of view, namely, the prevention and the relief of famine, the Commission recommended, in the first place, that better methods of cultivation should be introduced, and agricultural knowledge more widely diffused. In the second place, they recommended that measures should be adopted for the collection and record of those results of past experience and current events, which would enable the Government to deal systematically, effectively, and economically, with famine when it might arise.

These recommendations were considered by the Government of India; and though some points of detail were not approved, the leading principles were adopted and submitted for the sanction of Her Majesty's Government. This sanction was accorded in 1881, the Secretary of State, at the same time, defining the objects of the new Revenue and Agricultural Department to be—

1*st*—The collection and embodiment in convenient forms of the statistics of vital, agricultural and economic facts, in order that Government and its officers might always be in possession of an adequate knowledge of the actual condition of the country, its population, and its resources.

2ndly—The general improvement of Indian agriculture with the view to increasing the food-supply and general resources of the people.

3rdly—Better and prompter organization of famine relief, whenever the actual approach of famine might be indicated by statistical information.

While the objects of the new department were thus declared, the attention of the Government of India was invited to the necessity of establishing under local administrations a suitable machinery for the collection and record of statistical information, and for the improvement of agriculture throughout the country. It was the want of such machinery which marred the usefulness of Lord Mayo's plans; and to avoid a repetition of the failure which attended these plans the Government of India recommended, that provincial agencies should be created, to give effect to what was its settled policy in the matter of agricultural and industrial improvement, and the prevention and relief of famine.

Bengal Government letter No. 309TR, dated 1st June 1883.

These views of the Government of India were communicated to Sir Ashley Eden, who, in Mr. Macaulay's letter No. 29 of 3rd February 1882, declined to consider the question of local machinery as suitable to the circumstances of Bengal, and was disposed to trust to the impending legislation on the rent question for a solution of the difficulties with which those provinces have to contend in the absence of any agency for statistical research.

4 It seemed, however, to Sir Rivers Thompson, the present Lieutenant-Governor, that apart from the question of statistical information, the creation of an Agricultural Department was calculated to confer many benefits on the people of these provinces, and many administrative advantages on Government, and he accordingly submitted to the Government of India, in Revenue Department letter No. 309T—R, dated 1st June 1883, proposals for giving effect to his views on the subject, as well as to those which had been repeatedly expressed by the Government of India and Her Majesty's Secretary of State.

5. In the letter cited in the last paragraph, the Government of Bengal traced the history of agricultural and statistical enquiry, in these provinces, from the time of the Permanent Settlement, down to the more recent efforts of Sir George Campbell and his successors. It was shown that though partial success had attended the efforts of Sir George Campbell, yet nothing substantial had been achieved towards collecting trustworthy agricultural statistics, or obtaining correct records of rents or tenures such as are found in other parts of India. This defect was attributed to the want of village records and of a village agency, and could not, as far as permanently-settled estates were concerned, be remedied without special legislation, which was then in contemplation. The case was, however, it was stated, different in estates the property of Government and of disqualified proprietors. Government could make surveys and settlements of rents in them and establish village records under the powers afforded by the existing law. This policy, it was added, had the sanction of Her Majesty's Government: it had already been to some extent acted upon, and should, the Bengal Government remarked, be vigorously prosecuted wherever circumstances permitted, under the control of the Director of the Agricultural Department, whose appointment it was proposed to create. The Government of India, in expressing to the Secretary of State their general approval of the views of the Local Government, and in advocating the creation of a special department, laid particular stress on what it understood would, pending the adoption of more extensive operations, be the first duty of the new department, namely, the organization of the patwari staff and the preparation of a scheme for the collection of agricultural statistics in estates under the management of Government and of the Court of Wards. The number of such estates, it was remarked, was very great, and there was no obstacle to prevent immediate action being taken, to survey them and to establish in them the arrangements necessary for an actual record of rights. This duty, it was observed, would require the undivided attention of a separate officer for some time.

Despatch No. 13, dated 25th September 1883.

Despatch No. 24, dated 10th April 1884.

In reply to the despatch of the Government of India, Her Majesty's Secretary of State, while not withdrawing the approval with which his predecessors had regarded the prosecution of surveys and records of right in Government and wards' estates, desired, in order to enable him to judge of the expediency of establishing a separate agency to supervise such surveys, or of creating an agency to maintain their results, that he might be furnished with detailed information on certain specified points as to the mode of carrying the proposed operations into effect. He remarked, that from other correspondence before him, he was under the impression, that surveys and settlements had been already completed or undertaken in at least a great number of Government and wards' estates. His Lordship did not understand whether it was intended to perform this work over again, or, if not, what the Director would find to do, as far as such estates were concerned. To enable him to judge of the expediency of sanctioning any proposals for the formation of an agency for the supervision of survey and record operations in Government and wards' estates, Lord Kimberely accordingly called for detailed information as to the mode in which it was proposed to have such operations carried into effect.

6. The Right Hon'ble the Secretary of State, while doubting the feasibility of the objects at which the Local Government and Government of India ultimately aimed, and withholding his sanction to the creation of an Agricultural Department on a permanent footing, was disposed to admit the importance of providing the Lieutenant-Governor with the requisite agency for advising the Government generally in all matters relating to agriculture and statistics, as well as for undertaking the preliminary enquiries necessary in connection with the experimental survey of the Patna Division, which had been sanctioned by his predecessor. In the absence, he added, of those means of obtaining a satisfactory knowledge of the agricultural statistics of Bengal, which are supplied by the revenue organizations of other provinces, it was all the more desirable that every effort should be made to supply this essential requisite of good government,—it may be imperfectly, but still in the best manner practicable. Lord Kimberley accordingly sanctioned, as a temporary measure, for two years, the employment of an officer for the purpose above explained, and also for the purpose of collecting the information necessary, in order to enable the Government of Bengal to submit in a complete shape a detailed report on certain points connected with the management of wards' and Government estates, on which he desired further information. These points were—

(1) The number of such estates of each class and their approximate areas.
(2) What has as yet been done, what number and area of such estates have hitherto been dealt with in the manner proposed, and whether it is intended to do the work again.
(3) What system is proposed for (*a*) field survey, (*b*) village record, and (*c*) settlement of rents.
(4) What establishment is to be organized, and how it is to be controlled.
(5) What will be the approximate cost of the operations, and whence it will be provided, as regards both Government and wards' estates.
(6) What measures are contemplated, as respects wards' estates, to ensure the maintenance of the survey, the record, or the settlement, when the estate reverts to the management of its owner.
(7) Why, if an efficient subordinate agency can be framed, its general direction and supervision should not be entrusted to the Board of Revenue and the regular revenue authorities.

Duties Agricultural Department defined.

7. Under the authority of the provisional sanction conveyed in the despatch above quoted, I was appointed as the special officer referred to in the despatch, and was designated Director of the Agricultural Department. The Local Government, in a Resolution dated 2nd May, laid down instructions for my guidance and defined my duties and those of the officers who were placed

under me. The main questions to which my attention was primarily directed in that resolution were—

(*a*) The preparation of a scheme for the conduct of the experimental survey and record of rights in Behar.

(*b*) The elaboration of rules, and the organization of an agency for the maintenance and correction of the record of rights when prepared.

(*c*) The setting on foot of arrangements, in accordance with the provisions of the Tenancy Act, for the systematic and continuous record, verification, and publication of prices current of staple food crops.

(*d*) The preparation of the report called for by the Secretary of State on the points mentioned in paragraph 6 above in connection with the survey and management of wards' and Government estates.

Agricultural enquiry and improvement.

8. While particular attention was thus directed to the subjects, for which the appointment of a special officer had been provisionally sanctioned by Her Majesty's Secretary of State, it was also deemed desirable that advantage should be taken, with a view to agricultural enquiry and improvement, of the employment under the Bengal Government of gentlemen who had lately returned from the Cirencester Agricultural College,—one of them, Mr. Allen, being a member of the Covenanted Civil Service—another, Mr. Sen, being a member of the Native Civil Service,—while a third, Mr. Hossein, was a Deputy Collector of the Uncovenanted Service. The foundation, it was remarked, of an Indian Agricultural Department—

"should be the accurate investigation of facts with the view of ascertaining what administrative course is necessary to preserve the stability of agricultural operations. It is desired, therefore, that the new department should be so constituted as to give the fullest effect to this policy. The primary efforts of the departments should, when established, be devoted to the organization of agricultural inquiry, which has been shown to comprise the duties of gauging the stability of agricultural operations in every part of a province, of classifying the areas of the province according to the result of careful investigation, and of deciding what method of administrative treatment is suitable to each, so as to maintain agricultural operations up to the highest standard of efficiency possible under present conditions. From a system of agricultural inquiries thus conducted will follow the gradual development of agricultural improvement in its manifold variety. It will suffice if, on the first constitution of an Agricultural Department, the organization of agricultural inquiry is placed in the hands of qualified officials, to whom may be committed the subsequent preparation of carefully-considered proposals for agricultural improvement."

"Such a system of agricultural enquiry, it was added, the Lieutenant-Governor desires to inaugurate through the agency of the Cirencester graduates who are now in the service of this Government. It may not be necessary that the whole time of those officers should be devoted to agricultural matters. But agricultual enquiries are for one year to form the main object of their attention, and their other duties are to be regulated accordingly. Their primary duty should be to investigate and make themselves thoroughly acquainted with the native systems of agriculture in selected localities, with a view to the ultimate introduction of better methods of cultivation, better seed, more valuable staples, &c., where their enquiries may show that such improvements are practicable. The object in view will be best attained if they confine their investigations to typical villages of specimen tracts in selected districts. When they have thoroughly understood the native system of agriculture in any such typical village or local area, they should submit reports embodying definite suggestions towards improving the particular crops grown in those localities, and indicative of the manner in which Government can give the best practical aid in the introduction of improved methods of cultivation."

9. Such being the instructions laid down for my guidance and the agency placed at my disposal for giving effect to them, it remains to describe what has been done or attempted in the period under report—in connection with the special subjects mentioned under heads *a*, *b*, *c*, and *d*, of paragraph 7 above; and also in connection with the more indefinite subjects of agricultural enquiry and improvement. In treating of these subjects the order prescribed by the Government of India in their Circular No. 54, dated 28th April 1884, on the subject of the annual reports of Provincial Agricultural Departments, is adhered to as closely as circumstances permit.

Tours.

10. In accordance with the usual practice, I would, however, first mention that I visited the following places during the period under report, with the objects noted opposite each :—

January to May—Was principally engaged on Secretariat work connected with the Tenancy Bill; attended agricultural exhibition at Doomraon, also *en route* from England visited Poona and Cawnpore to consult the Directors of Bombay and North-Western Provinces and Oudh.

May 1885.—Visited Burdwan, Bankipore, Ghazipore—to start work of Agricultural officers and make enquiries regarding system of survey and record of rights.

June.—Mozufferpore, Sewan and Ghazipore, for same purpose.

July.—Bankipore and Mozufferpore.

August and September.—Burdwan, Bhagulpore and Monghyr—inspection duty.

October.—Darjeeling—for preparation of Tenancy Act rules.

November.—Barrakur ironworks—enquiry connected with manufacture of ploughs and other agricultural implements.

Mozufferpore—to make arrangements to start survey work.

January 1886.—Dacca—enquiries regarding preparation of jute forecasts.

Mozufferpore, Bhagulpore—on inspection duty.

February.—Pirpointee, Bhagulpore, Bankipore, Mozufferpore—on inspection duty.

March.—Doomraon, Arrah and Nasrigunge—inspection duty; attended agricultural exhibition at Barrahpore, visited Rhotasgurh, to make enquiries regarding establishment of fodder and fuel reserves.

April 1886.—Barrakur ironworks.

Messrs. Allen, Sen, and Hossein visited various parts of the divisions to which they were respectively attached.

CHAPTER I.—ORGANIZATION AND MAINTENANCE OF VILLAGE RECORDS.

SECTION I.—*The Cadastral Survey, record of rights, and settlement of rents in Mozufferpore.*

11. The principal work done under the head of the organization and maintenance of village records was the institution of the experimental survey and record of rights in Mozufferpore. The circumstances which led to the undertaking of this survey and record of rights, as an experimental measure, are generally well known, and need only be briefly referred to here, in order that the aims and objects of the work may be apparent without reference to the mass of literature that exists on the subject, and also in order to afford materials for the formation of a judgment regarding the measure of success, or the reverse, which has attended the operations so far as they have gone.

Circumstances which led to the undertaking of survey and settlement operations in Mozufferpore.

12. It will be in the recollection of those who followed the discussions connected with the passing of the Tenancy Act that it was frequently asserted during the course of those discussions—and that no serious attempt has been made to refute this assertion—that it was proved by indisputable evidence that the rents of occupancy and non-occupancy ryots in Behar have during the past fifty years been illegally and arbitrarily enhanced out of all proportion to what the landlords were under the law entitled to demand, and to what the tenants were legally liable to pay. This state of things was attributed mainly to the fact that, though the rent law, as it stood before the passing of the Tenancy Act, gave the ryot certain rights, yet he was so helpless or so ignorant that he was, in Behar, unable to assert these rights out of court, or to go into court to enforce them. The result was that illegal and

arbitrary enhancements of rent were imposed, without resort to the courts, at the mere will of the landlord. Enhancement suits were seldom or never had recourse to in order to effect enhancements, and if resort was occasionally had to the agency of the courts, that appeal was made, not by way of suing for enhancement, but by suing for an alleged arrear of rent at the enhanced rate, which it was sought to enforce, such suits being supported by fictitious rent-rolls, manufactured for the occasion, in which the enhanced rents claimed were shown as being the rents previously paid. Recourse to this practice was possible, because the ryots had no documents defining the areas of their holdings or the amounts of their rents, such proof as existed on these matters being entirely monopolised by the landlords. It resulted that the law, so far as it was intended to protect the ryots in the enjoyment of their lands at fair rents, was a dead letter in Behar, and that their condition in 1878 was such, that they were at that time described by Sir Ashley Eden, the then Lieutenant-Governor, as "poor, helpless, discontented men, bound down to a "state of extreme depression and misery, tenants of the richest province in "Bengal, yet the poorest and most wretched class we find in the country." "The loose system of zemindari accounts," Sir Ashley Eden remarked, "the entire absence of leases and counterparts, the universal "prevalence of illegal distraint, the practice of amalgamating "holdings so as to destroy evidence of continuous occupa-"tion, are evils which necessarily prevent any possible "development of agricultural prosperity among the tenant "class, and place them entirely at the mercy of their landlords. There is," "it was added, "a general concurrence of opinion that the law should be a "simple and effective procedure to enable a ryot—

Illegal and arbitrary enhancements of rent.

Bengal Government letter No. 2122, dated 7th September 1878, to the Commissioner of Patna.

"to maintain his right of occupancy when acquired,
"to hold his land subject to fixed conditions of tenure,
"to be certified exactly of the amount which he will have to pay on it annually,
"to resist illegal distraint, illegal cesses, and illegal enhancement,
"to have at hand a trustworthy record of demands and payments."

13. The unsatisfactory condition of the peasantry of Behar did not fail to attract the attention of the Famine Commissioners, who, after having visited that Province and compared what they saw there with what they had observed of the state of the peasantry in other parts of the country, remarked as follows:—

"Where—as in Behar, the relations of landlord and tenant are those of a "high-handed proprietary body on the one hand, habitually disregarding the "law, and on the other a tenantry ignorant, very helpless and sunk in the "most abject poverty, the onus of bringing complaints of oppression ought "not to be laid on the tenants, and the first and most imperative duty of the "Bengal Government and of the officials would seem to be to guard zealously "against infringements of the law by the rich, and to put them down as if "they were offences against the public peace."

14. It struck the Famine Commissioners, as it must strike anybody who has an opportunity of ascertaining the facts, and gives a moderate share of attention to the subject, that the fundamental want in Behar as regards security of tenure is an authoritative record of existing rents, supplemented by effectual measures for prevention of arbitrary enhancement of these rents: in other words, for the prevention of arbitrary confiscation of property vested by law in the ryot. It was obvious that it is useless to impose restrictions on future enhancements of rent, when there are no sufficient means in cases of dispute, of ascertaining the amount of the present rent, or when all proof on the subject is in the hands of one of the parties, and it is open to that party to represent the existing rent at any figure he may wish, while the other and weaker party has no evidence to rebut this contention. Under these circumstances, it is as futile to impose such legal restrictions on enhancement as can be brought into operation only at the instance of the ryot, through the action of the courts, as it would be fatuous for a landlord to sue for enhancement when he can achieve his object by simpler means. Therefore it was

Possibility of enhancements due to want of record certifying to the ryot the amount of his rent.

that the Behar Rent Committee, composed as it was, of experienced local officials of all shades opinion, of indigo planters, and zemindars, unanimously recommended that landlords should be bound to file in a public office, accounts showing the amount of each ryot's rent and the area of his holding. These accounts might be verified and tested by a public official in the presence of the ryots concerned and a basis might thus be established on which subsequent enhancements or reductions of rent might be made according as prices might rise or fall; without some such basis to start from, it was recognized by the Behar Committee that all other restrictions on future enhancements would be practically inoperative. The Bengal Rent Commission, whose members had little or no practical acquaintance with Behar, set aside, it will be remembered, the recommendations of the Behar Rent Committee on this point, and substituted the scheme of a Table of Rates, by which it was thought, the object in view could be more effectually attained. Finally, it was found that the scheme of a table of rates was impracticable, and the plan of a cadastral survey and record of rights was adopted, as affording the most effectual means of ascertaining, and certifying to the ryots the amounts of their existing rents, and of recording rights, and that plan was accordingly embodied in Chapter X of the Tenancy Act.

Survey and record of rights thought to be the only effectual way to supply this want.

15. The district of Mozufferpore having been selected for the first trial of the experimental survey and record of rights, I was directed to proceed to the North-Western Provinces, and to ascertain what was the most approved practice in those districts where cadastral work similar to that contemplated in Behar was in progress, and what modifications might be necessary in introducing the system in Behar. In accordance with these instructions, I visited the Gorruckpore, Benares and Ghazipore districts, and examined the systems of survey and record there followed. In light of the knowledge thus acquired, and of personal experience of similar operations in Durbhunga and Midnapore, I prepared a set of instructions, according to which operations have been conducted in Mozufferpore. These instructions were drawn up in conformity with the requirements of the Tenancy Act, and of the rules made under it, and differ from those in force in Benares and Gorruckpore in the following respects :—

System of survey and settlement described.

1st—That the external boundaries are measured with a Gunter's chain, the internal plots being measured with a chain sub-divided into decimal parts of a linear bigha, being also plotted to scale in bighas; while in Benares the measurements were made entirely with the Gunter's chain, and the areas were worked out in acres.

2nd—That though the officers of the Survey Department record areas of holdings, facts of undisputed possession and occupation, of crops grown, of irrigation, they do not record amounts of rentals of holdings, nor deal with any questions of right or status, as is done by survey officers in the North-Western Provinces. Such questions are enquired into and determined by the revenue officers alone in Mozufferpore. The reason for departure from the practice followed in Gorruckpore and Benares in this respect, is, that in Gorruckpore and Benares rights are capable of determination by reference to old records, and are easily understood by the people concerned, while there are no such records for Behar, and it would therefore be inexpedient to allow amins to determine any questions of right under the provisions of the Tenancy Act.

The practice which prevailed in Benares and Gorruckpore, of having the internal plots measured with a Gunter's chain, and plotted in acres was departed from in the expectation that certain advantages would accrue from the use of a chain graduated to parts of a bigha.

These advantages were —

1st—That the people understand what is being done when measurements are made with a chain in a standard with which they are familiar.

2nd—That areas of fields being ascertained once for all in bighas, it is not necessary to convert them into areas in acres, and thus a great amount of unnecessary trouble is avoided.

3rd—Measurements being made with a standard which is intelligible to the people, it was hoped that local men would be able to learn the system of measurement, as the work progresses on the spot, and thus that a local agency might be trained for correcting the maps and survey records from

time to time, and for carrying on the survey of other parts of Behar in future years. This hope has been amply fulfilled, as it has been found that suitable local men can be obtained in large numbers and that they can be easily trained for survey work, so that in a short time there would be no difficulty in carrying out the survey of Behar through them alone.

The rules and instructions thus drawn up, having been approved by the Board of Revenue and Government, were subjected to the criticism of the Behar Landholders' and Indigo Planters' Associations, and were accepted by these bodies as being fair to all parties concerned.

16. The cadastral survey has been conducted by a professional survey party under the superintendence of Colonel Barron of the Survey Department, who recently completed successfully the survey of the Benares district. The work of record of rights and settlement of fair rents is being carried on by Mr. Collin, C.S., with the assistance of two Sub-Deputy Collectors under the immediate supervision of the Director of the Agricultural Department, acting in this matter, in immediate subordination to the Board of Revenue. The officers of the Survey Department record the areas of holdings, facts of undisputed possession, of crops grown, and of irrigation. The maps and the measurement records of each village, according as they are completed, are at once made over to the settlement officers, who immediately proceed to the village and themselves determine and record the status and interests of all parties from the proprietor down to the under-ryots. They also record amounts of existing rents, and settle and record fair rents on the application of either landlord or tenant, and without such application also, when it appears that the tenant is holding land in excess of, or less than, that for which he is paying rent. The objects of the survey and record of rights, and the system under which it has been attempted to attain those objects, having been thus described, I proceed to state the progress which was made in this work up to the end of July, with the results, so far as they can be stated at this stage of the proceedings.

Progress made in survey and settlement of Mozufferpore.

17. The total area cadastrally surveyed to the end of July was 413 square miles. The rents had been recorded and the status had been determined of 26,123 tenants, while fair rents had been settled, on the application of either landlord or tenant in the cases of 7,520 ryots. Boundary disputes, of which there were 326, mostly of a petty character, had been in the great majority of cases amicably settled, and in only a few cases had an appeal been made from the decisions of the settlement officers, to the District Judge, who has been appointed Special Judge under the Act. There had not been a single breach of the peace in connection with the proceedings. The tenants whose status had been determined are classified thus—

	No.	Percentage on total
Cultivating tenure and undertenure-holders ...	12	0·04
Ryots at fixed rates	948	3·63
Settled ryots	21,750	83·26
Occupancy ryots, but not settled	250	0·96
Non-occupancy ryots	1,608	6·16
Under-ryots	1,555	5·95
	26,123	100·00

18. The average area of separate holdings under separate proprietors is one acre, but the same ryot ordinarily occupies more than one holding. The average total area held by a ryot, whether under the same or different landlords, is, so far as can be ascertained, about three acres. The records of 30 villages had up to the end of July been published, copies of the entries relating to their holdings had been distributed among the ryots of these villages, and objections had been made to only 32 of these entries. In all cases in which fair rents had been settled, the existing rents were recorded as fair. The law presumes that existing rents are fair till the contrary is proved, and does not permit of their reduction, except on the ground of a fall in the prices of staple food crops since the rents were last fixed, or on the ground that the area of the holding is less than that for which the ryot has been paying rent. Neither of these grounds (which alone justify

reduction in present rents in order to arrive at fair rents, as defined in the Tenancy Act) having been found to exist, it necessarily results that existing rents cannot be reduced in order to arrive at the fair rent. On the other hand, landlords have not shown that prices have risen since the rents were last fixed, nor have they adduced evidence that the ryots are holding lands in excess of that for which they are paying rent, so that the result, so far as the proceedings have gone, has been, that the existing rents have in every case been recorded as the fair rents. Unauthorized cesses and abwabs have not been recorded.

Cost.

19. The total cost of the operations of both survey and settlement to the end of July was Rs. 1,44,032, or nearly 9 annas per acre on the area which had been cadastrally surveyed. In this amount, it is to be remembered, is included the cost of tents and other camp equipage, of transport, travelling allowances to officers joining their appointments, and other items of expenditure, which, though necessarily incurred when a survey party is organized for the first time in a district, yet cannot be fairly charged to the comparatively small area which is surveyed in the first season, and ought to be spread over several years' work. This expenditure also covers the cost of the professional boundary survey of a large area in advance of the cadastral work.

It is not possible at the present stage of the proceedings to give an exact estimate of the cost at which the combined operations may be effected, when the survey and settlement parties are in full working order, but, as far as present experience enables the survey and settlement officers to form an opinion, it may be confidently stated that the total cost of the operations need not exceed 8½ annas per acre, or about a tenth part of one year's rental. For an answer to the questions, whether the advantages that may reasonably be expected from these operations, would be dearly bought at this price, and whether there would be any hardship or injustice in realizing the whole of the cost locally from the parties interested, I would invite a reference to the facts noted in the sequel in paragraphs 37 to 40.

20. It would be premature with the information now available to pronounce a final opinion on the benefits which may be expected from these operations to the landlords and ryots concerned; but if the success of the work may be judged by the absence of that friction and of those difficulties which were anticipated in connection with the proceedings, the experiment may be said to have been so far eminently successful. There has been no opposition on the part of the landlords, and the settlement officer reports that the ryots have now begun to understand the aims and objects of the operations, and are showing a keen interest in them The statement which has been made by some parties, that the ryots are opposed to the survey and settlement operations, is, therefore, absolutely untrue.

Absence of friction or opposition, and causes thereof.

21. The absence of friction in the conduct of the operations, so far as they have gone, though doubtless in some degree due to the tact and patience with which the work has been supervised by Mr. Collin and Colonel Barron, and it may be thankfully acknowledged in some degree also to the absence of everything like factious opposition on the part of the Behar Planters' and Landholders' Associations and their Secretaries, yet is in the main, in my opinion, due to the fact that the provisions of the Tenancy Act, as understood and interpreted by the settlement officers, with the Board's approval, tend strongly to maintain the *status quo*,—reductions in existing rents, on the one hand, being under the Act impossible, be those rents ever so high; while, on the other, under the circumstances existing in Mozufferpore, no ground for enhancement has been shown. It is to be borne in mind, as already observed, that under the provisions of the Act existing rents must be presumed to be fair, and that they cannot be reduced by the settlement officer, except on production of proof before him, that the price of staple food crops has fallen since the rents were last fixed, or on the ground that the tenant is holding less land than that for which he is paying rent. But rents have been so often changed, and consequently, so recently fixed, that it would in most cases be impossible to prove a fall in the price of the produce since they were last fixed. For the same reason, it is impossible for the landlord to obtain, under the circumstances, an enhancement on the ground of rise in prices.

With regard to enhancement or reduction on the ground of increase or decrease in area of the holding, the case is similar. The existing rental is presumed to be the fair rental for the total area found in the ryot's possession, whether that total, turn out by measurement, to be a little more or less than the number of bighas shown in the landlord's rent-roll. If the landlord claims an enhancement on ground of excess area, he must show that since the beginning of the tenancy the tenant has occupied new land which was not included in the original holding; and, similarly, if the tenant claims a reduction of the existing rent on ground of decrease in area, it is not enough for him to show that the nominal area expressed in bighas, which varies according to the system of measurement, is less than was supposed, but that he has lost part of the land included in the original letting. Under this interpretation of the law, neither has excess area been shown on one side, nor decrease in the area of holdings on the other, and the result, is that in every case where applications to settle fair rents have been made, the existing rents have been recorded as the fair rents, and no evidence to rebut the presumption of fairness has been adduced on either side. This is the circumstance which, in my opinion, has mainly tended to obviate friction and opposition.

Are the rents being recorded as fair and equitable in reality such?

22. It would be out of place to discuss here at any length the question whether the rents now being recorded as fair and equitable are in reality such. The Tenancy Act declares that existing rents must be presumed to be fair, and leaves, as has been already stated, no power to the settlement officers to reduce them, except where it is shown that the price of the produce has fallen since they were last fixed. Prices have not fallen in Behar within the short periods since rents were last fixed, and in this technical sense it may therefore be said that the rents which are being recorded are fair, but it is evident that it would be arguing in a circle thus to define the existing rent as the fair rent, and then to say it is fair because it exists. To record rents as fair in this manner can in no way constitute them as fair and equitable according to the common interpretation of those terms. But though it would be premature, at the present stage of the operations, to discuss at length the question whether these existing rents, which are necessarily being recorded as fair and equitable, are in reality such in any true or solid sense of these words; yet it may be here remarked that if, as the Government of India was satisfied in 1882,* "the majority of the ryots in Behar are rack-rented," it follows that the character of these rents will not be altered by merely calling them fair. Though the question of the effect of stopping the survey and record of rights in Behar, cannot be discussed at length in this report, I may perhaps here express my conviction, that if these operations are stopped, and if no other measures are taken to certify to the ryot the amount of the rent for which he is annually liable, the ryots of that part of the country will, for all practical purposes, be, in the future, in no way in a better position, than they would have been, if the Tenancy Act had not been passed. The previous law of landlord and tenant was, as far as the ryots of Behar were concerned, a mere declaration of their rights recorded in the Statute book, but seldom or never brought into practical operation, because, as remarked by Baboo Bhoop Sen, himself a zemindar and Government Pleader of Gya, the ryot was unable to go into court and assert his rights. The new Act without the enforcement in Behar, on the part of Government of a general survey and record of rights or of some similar method of certifying to the ryot the amount of his present rent, will be a new declaration of right, published in the Gazette, and recorded in the Statute book, but for the rest, as inoperative as its predecessors. There is only one provision in the Act, which can be conceived to be capable of producing within the present generation, any change in the existing order of things, namely, that which makes it compulsory on the landlord to give receipts specifying the area of the ryot's holding, and the amount of his rent. But apart from the circumstance that the old law, also made it incumbent under severe penalties, on the landlord to give receipts, and that yet these receipts were not given in conformity with the requirements of the law, it may further be remarked, that enquiries have been made, and it has been ascertained as a fact, that receipts in the prescribed form are not

* Despatch No. 6, dated 21st March 1882.

Results of stopping the survey.

being given in the area now under survey, save in exceptional cases, of which instances have been reported by the settlement officers, in which the landlord's part of the counterfoil receipt has been produced against the tenant, as proof of the latter's liability to pay amounts alleged by him to have been fraudulently entered by the landlord in excess of the true rental. At the meetings of the Behar Rent Committee, compulsory use of counterfoil receipts was opposed by Messrs. Gibbon and Anderson, two of the most experienced planters in Behar, on this very ground, that as the counterfoil part necessarily remained with the landlord, there is nothing to prevent him, if so inclined, from making false entries in his part, while he may withhold the ryot's part altogether, or enter something different from what is entered in his own half of the counterfoil. The total number of counterfoil receipts sold in Mozufferpore is not more than one-tenth of the number of holdings, but assuming that every ryot got a receipt in the new form, the argument would still remain unaffected. The Tenancy Act, in its ordinary operation, will in no way then certify to the ryot the amount which he will have to pay annually; it will not enable him to resist illegal cesses, nor illegal enhancements; nor will it enable him to have at hand a trustworthy record of demands and payments,—all of which things were rightly said by Sir Ashley Eden's Government, in 1878, to be fundamental necessities. The Act will doubtless extend the right of occupancy and facilitate the proof of it, but, as was pointed out in a note by Mr. Reynolds in 1880, the mere right of occupation, unaccompanied, not alone by the right, but also by the enforcement of the right to hold at a fair rent,—is a mockery, and the extension of it a worthless boon. For these reasons, I am of opinion that the Tenancy Act, without the general enforcement in Behar of a survey and record of rights under Chapter X, or of some such method of certifying to the ryot the amount of his rent as was recommended by the Behar Rent Committee, will not have any effect, whatever, in remedying the main evils from which ryots in Behar are suffering. On the contrary, I think—and I am sure there is not a planter in Behar who really differs from this opinion—that the ryot's position in that part of the country, after these years of discussion and earnest effort for his protection, will be, that of the boy described in Don Quixote. "The Knight of La Mancha delivered the lad from his master's whip, made the master swear to pay the wages which the boy claimed, and rode on his way rejoicing at the wrong which he had redressed. When he was out of sight, the master again bound the lad to the tree and flogged him worse than before."

Agricultural improvement impossible without security of tenure.

23. I have thought it necessary to dwell on this subject at some length, both with a view to describe what has hitherto been done, and also because, in my opinion, there can be no agricultural improvement in Behar till the great mass of the population get reasonable security for the enjoyment of the fruits of their industry. At present there is no such security. It may be, and I think it is a fact, that the survey and record of rights under the Tenancy Act, would not go very far towards securing the tenantry in the possession of their holdings at really equitable rents; and it may also be, that, even if they had such security, considering the redundancy of the agricultural population, and their poverty and ignorance, much would still remain to be done before the condition of the Behar tenantry could be considered other than discreditable. But these operations would at all events, it may be hoped, prevent further arbitrary and inequitable enhancements for a period of fifteen years. Without a survey and record of rights, or some similar means of ascertaining, and certifying to the ryot, the amount of his rent, it is difficult to see how the Tenancy Act can afford any more protection to the ryots of Behar than Act X of 1859 or Act VIII of 1869 did; and in that view it would appear to me to be a hopeless undertaking for an Agricultural Department, or any similar agency, to attempt anything in the way of the introduction of agricultural improvement in Behar generally. As long as those who plough, and sow, and ought to reap, have no reasonable assurance of enjoying the fruits of their industry, it will be futile to attempt to introduce agricultural improvement in Behar, and an Agricultural Department in making the attempt will be building on quicksands. The law recognizes the right of Behar ryots, like that of ryots elsewhere, to hold their lands at certain rates of rent. It has been over

and over demonstrated, beyond possibility of doubt, that present rents have been enhanced manifold, beyond the rates justified by law; and that they are still being enhanced—whether by force or by taking fraudulent advantage of the tenant's ignorance and helplessness to a degree out of all proportion to what the law contemplates—is known on other grounds, and will be also seen from the statements prepared by the Assistant Settlement Officer in charge and reproduced in Appendix III. Such enhancements appear to be as real and true confiscations of the property of one class for the benefit of another as it would be for Government to arbitrarily enhance the amounts payable by the zemindars as their Government revenue. The law does not recognize this confiscation, but the Behar ryot derives no benefit from a law, the effectual enforcement of which, is not insisted upon. I was in Behar before Sir Ashley Eden's Government denounced zemindari abuses in 1878, and I have been there, at intervals, ever since that time. I have had opportunities of judging of the condition of the tenantry of that part of the country, and of ascertaining what the relations between landlord and tenant really are, such as few officials have had; and save that there have in recent years been, so far as I know, no outbursts of open violence, and that indigo cultivation has been put on a somewhat more satisfactory basis, I can find no reason to think that any one of the evils which were so vigorously and rightly denounced in 1878, and the following years, have been mitigated to any appreciable extent; and even as regards cultivation of indigo, I cannot say that I think that this industry is as yet on anything like a commercial footing. It is true that the Indigo Planters' Association have agreed to bind themselves by rules, under which they are to pay the ryot more than was formerly the case for cultivation of indigo on the Assamiwar system, and that they have also bound themselves not to ask the ryot to sow with indigo more than three cottahs in the bigha of his upland. But under a voluntary system, it is evident that the ryot should not be asked to sow a foot of his land with indigo, if it does not pay him to do so; while if it does pay him, the area thus to be sown need not be restricted to three cottahs in twenty, or to any other proportion. Again, the increase in the amount paid the ryot for cultivation of indigo may be nominal, and I think often is so, when no money really passes from the planter to the ryot, the sum due to the latter for indigo cultivation being credited as a set-off against his rent. Thus, in one case, which was reported to Government at length in 1878, an arrear of rent was shown in the landlord's rent accounts against the ryots of an entire village equal to ten times the annual rental. The ryots of this village had been paying their rents with regularity, during the previous ten years, and were under the impression that they owed an arrear of about one year's rent, which they said accrued in the famine year of 1874. The ten years' accumulated arrear shown against them in the landlord's accounts represented rent of all the land which had been abandoned by other ryots or which had gone out of cultivation from the most ancient times downward to that day. The rent of this land was shown as a debt due from the ryots who remained, and compound interest was charged upon it at 12 per cent. per annum. A nominal sum of Rs. 6 per bigha was allowed the ryots of this village for cultivation of indigo on the Assamiwar system. No money, however, passed, the amounts due to the ryots on this head being credited as a set-off to this fictitious arrear of rent. My attention was attracted to the case by finding the roofs of the ryots' houses in this village, being dismantled in the middle of the rainy season, and sold in execution of decrees, for arrears of rent and for damages for failure to sow indigo on what were called *novista khand* agreements on these terms. It made no difference to these ryots whether the nominal remuneration for the cultivation of indigo was Rs. 6 or Rs 16 a bigha. The village in question was the head-quarters of one of the oldest munsifis and subdivisional offices in Behar, and the case may be noted, as one out of many which I might mention, as showing, not alone how illusory may be the nominal increase in remuneration for growth of indigo, but also how futile it is to hope that the action of the courts alone will produce any appreciable effect in remedying the abuses that exist in Behar.

24. If the cultivation of indigo were on a commercial footing, in 1878 there would have been no need of an Association; and if it was not on a commercial footing in 1878, when the Association was formed, it is scarcely

reasonable to hope that it has been since put on a commercial basis, by a voluntary combination of business men, to forego their own profits. Indigo cultivation in Behar is not, and never can, in my opinion, be, on a commercial basis, unless and until the planter buys the land from the ryot or purchases his indigo on the bundle system. As long as he depends for cultivation of his indigo on zemindari influence, acquired as thikadar, it cannot be expected that the cultivation will be entirely voluntary. I acknowledge that some good has been effected by the Association, and I admit that the planters as a body are willing to deal fairly by their ryots, but the thikadari system under which they generally acquire their land for indigo, and which is not one of their creation, is inherently bad, and as long as that system continues, the cultivation of indigo in Behar in the Assamiwar system cannot be purely voluntary. I do not, however, think that the evils from which the Behar ryot is suffering can now, nor do I think that they could at any time, have been fairly attributed, to indigo cultivation. Indigo cultivation may have evils *sui generis*, but the industry among other benefits introduces capital in Behar, and, in my opinion, ryots are better off in tracts where it is grown than where it is not.

25. Great injustice has been, and is being, done to the tenants of Behar, not through any undue partiality of the law towards the landlords, but from inability on the part of the executive Government to enforce the law. I believe that this injustice will continue, and become aggravated, in the future, if the ryots of that part of the country are left to look after their own interests, and executive action is not taken to certify to them, the amounts of their rents, and to protect them from the illegal enhancement of the rents so certified. Act X of 1859 was not enforced, neither was Act VIII of 1869. If the enforcement on the part of Government of chapter X of the Tenancy Act—the only part of the Act that is of any real efficiency for the protection of Behar tenants—is now also to be abandoned, it is difficult to see how the passing of that Act can make any change in the relations of landlord and tenant in Behar. I do not, however, say that a survey and record of rights is the only way by which the ryot may be certified of the amount of his rent. It is no doubt the most effectual way, but the same end may, I think, be attained, cheaply though it may be imperfectly, by such a measure as the Behar Rent Committee recommended.

SECTION II.—*Maintenance of Records and Organisation of Village Agency.*

26. Another matter to which my attention was directed in the Resolution of the 2nd May was the procedure for maintaining the record of rights, when prepared, and the organization of the agency requisite for that purpose. On this subject a special report was submitted in November, in which, after inquiry into the system in force in the North-Western Provinces, and consultation with Major Pitcher and other officers acquainted with the practical operation of that system, I stated at length my views as to the method and the agency by which the records might be maintained in Behar. I submitted at the same time a set of rules worked out in detail, and suggested some minor modifications in the Patwaree Bill, then under consideration of the Bengal Legislative Council. The scheme then submitted, was based on the assumption that an officer—whether called patwaree or by any other denomination—was to be appointed by Government, for circles of about ten square miles each, or such other extent as might be found to be convenient; that this officer should receive a salary of about Rs. 20 per month, more or less; that landlords should be bound to file in his office annually, or at shorter periods, statements and accounts showing the changes that may have taken place during the previous year, as regards the entries in survey and settlement records, of which records copies were to be furnished to the landlords; and that the officers thus appointed should then verify the statements and accounts thus filed by personal enquiry from each ryot. These officers were themselves to have no power to decide on any difference that might arise, or on any discrepancy that might appear between the statements of the landlord and tenant, but they were merely to make a record of the contemporaneous allegations of both parties, so as to prevent fabrication of evidence to suit the exigencies of the moment, and

also to afford the courts materials for forming judgment on such disputes when brought before them, instead of relying, as they now do, either on a mass of chaotic jumabundi papers, fabricated for the exigencies of the case, or on perjured oral evidence. As with the record of mutations, so also with the system of keeping ryots' accounts, the landlords were to be empowered to utilize the services of the Government patwarees for keeping their ryots' accounts, if they thought fit, but it was likewise open to them, if they so desired, to make their own arrangements to keep their accounts without the interference of the Government patwaree. In this latter case they were to file copies of those accounts in the office of the Government patwaree, or canoongoe as he might be more properly denominated, and it would be the duty of this officer then to verify by enquiry among the ryots the accounts so filed, in the course of which enquiry he would, in case of discrepancy between the landlord's accounts and the ryot's statements, make a note of the allegation of both parties without attempting to adjudicate between them. It was suggested that these officers should be supervised by a revenue officer of the rank of Deputy Collector, of whom there should be one for every 500 square miles, whose duty, among other things, it would be, to keep moving about his circle, inspecting the work of his subordinates, explaining, where necessary, to both landlord and tenant their rights and liabilities, and endeavouring amicably to adjust differences between them. A hope was expressed that when a record of rights had been prepared, and accounts had been checked, and their rights had been explained to all parties by the Deputy Collector, in this way for a few years, it might then be found possible to safely allow a summary procedure for the realization of rents undoubtedly due, in tracts in which records had been thus prepared and maintained. The cost of this establishment it was proposed to meet by the levy of half an anna in the rupee on the rental ascertained at settlement. This rate was to be in substitution for, and not in addition to, the abwab of similar amount, known as *hisabana*, now levied by zemindars in Behar, for the purpose of paying the village patwaree, who as at present constituted is, according to the Secretary of the Behar Planters' Association, a "curse to both landlord and tenant," and who, as Mr. MacDonnell truly remarked in the Bengal Legislative Council, "preys upon the tenants "and foments dissensions among the landlords. His peculations know no "bounds and his conscience no scruple. He does nothing without a fee, "and if for a fee he gratifies the ryot, he also for a fee forswears himself to "please the landlord."

The scheme above described was laid before the Behar Landholders' and Indigo Planters' Associations, and was generally accepted by those bodies. It was also approved generally, by the Board of Revenue.

27. The Secretary of State having, however, it is understood, vetoed the imposition of a cess for the maintenance of the records in any shape or form, either in substitution for, or in addition to, any existing cess for the maintenance of village accountants, the scheme and the rules referred to cannot come into operation in Behar generally, but they may, it is hoped, be found useful for guidance of Government officers in maintenance of settlement records in Government estates at least, and, I should think, in wards' estates also

28. While obviating needless and harassing interference on the part of a petty official between landlord and tenant in the daily transactions of life, the system sketched out above, would appear to afford the ryot all the protection which is necessary, and which can be afforded to him in the matter of keeping his accounts: it would at the same time afford an effectual means of maintaining the records corrected from year to year, so as to represent the existing state of things, and would also, without undue risk of sacrificing the ryot's interests, afford the only possible basis of a summary procedure for realization of rents admittedly due, which landlords have so long and so often sought in vain.

29. There was no assertion more frequently made before the work of survey and record of rights was begun in Mozufferpore, than that these operations would lead to strife and litigation, that they would stir up animosity where none existed, and that it would in fact be impossible to carry them into execution, yet there has not been a single breach of the peace in connection with them. Events have thus proved that if carried on with

some knowledge of the facts to be dealt with, with care and patience on the part of the officers immediately responsible, and with due regard to the feelings of the parties concerned, such operations need stir up no bitter passions—at least in Behar, where the system of land tenures is simple—nor need they lead to any litigation, except such wholesome litigation as is necessary in order to determine the rights of parties where they require definition. The scheme and rules for the maintenance of the records would, I venture to think, had it been found possible to allow them a trial, have worked as smoothly and harmoniously as the rules and instructions for the conduct of the survey and settlement operations have, in practice, been found to work.

SECTION III.—*Detailed information called for by the Secretary of State regarding organization of an agency for supervision and maintenance of records in Government and Wards' Estates.*

30. It has been already observed that the Local and Supreme Governments, in asking the sanction of Her Majesty's Secretary of State to the creation of an Agricultural Department in Bengal, laid particular stress on what, it was understood, would be the first duty of the department, namely, the organization of a staff and preparation of a scheme for the conduct of surveys and records of right, and for the collection of agricultural statistics in estates under the management of Government or the Court of Wards. The Secretary of State, as above stated, remarked in reply that he had understood that surveys and records of right, had already been undertaken, in at least a great number of these estates, and he called for detailed information as to what had been done and what remained to be done in this respect.

31. My services were, under the resolution of the 2nd May, placed at the disposal of the Board of Revenue for employment, as far as other duties permitted, on those enquiries that might be required in order to supply in a complete shape the information called for regarding wards' and Government estates. Enquiries were accordingly made from all Commissioners and Collectors, and a special report embodying the results of these enquiries, with the reports of Commissioners, was submitted to the Board with my letter No. 390, dated 7th July last.

Results of enquiries regarding wards' and Government estates. Area of these estates in Bengal equal to half of England.

32. Here it may be briefly stated, that the outcome of these enquiries shows, that the approximate area of Government estates in these provinces, is somewhat over five millions of acres, and of wards' estates over ten million acres; that the wards' and Government estates together, under the management of the Government of Bengal, embrace an area of more than twenty thousand square miles, or about half the area of all England; that of the total area included in Government estates, 67 per cent. was surveyed at some time or an other; that of the total area of wards' estates, only 16 per cent. has ever been surveyed, and 84 per cent. has not been surveyed, and that, taking Government and wards' estates together, one-third has been surveyed and two-thirds remain to be done. Further, it appears that, except to a partial and very inadequate degree in Khoorda, no attempt is anywhere made to keep the survey and settlement records corrected from year to year, so as to represent the existing state of things; that the result is that these records soon cease to be of any value. It also appeared that, though the maps and records hitherto prepared were, generally, rough sketches and chittas, which cannot be compared, for efficiency or accuracy, with the printed maps and accurate work of the professional survey and settlement parties, yet the cost of this rough work, had exceeded the cost of professional survey and settlement work, as now conducted by the most skilled agency in the North-Western Provinces.

33. It was likewise shown that the current settlement of 900 square miles of temporarily-settled estates in Angul will expire next year, and that of 1,900 square miles in the Julpigoree Dooars well expire in 1891; that the settlement of 1,600 square miles, involving the survey of the whole of the Chittagong district, with an area of 2,567 square miles, will begin to expire

in 1892; while the settlement of all Orissa, with an area of 9,000 square miles, will expire in 1898. As the survey of all these estates must be undertaken, and ought to be well advanced towards completion before the current settlement of them expires, the conclusion suggested was that this work, involving the survey and settlement within a limited period, of an extent of territory as large as the entire province of Oudh, would alone require the undivided attention and tax all the energies of a special department.

Necessity for a special agency for management of wards' and Government estates.

34. Besides inviting attention to the fundamental necessity for the creation of a special agency for the conduct of surveys and records of right, in these temporarily-settled and in Government and wards' estates, it was suggested that, over and above these arrangements, it is also necessary to train a skilled agency for the management of such estates. On this point the remarks made in the special report may be here repeated:—

"It remains," it was said, "to consider whether, over and above the arrangements for prosecution of surveys and records of right, any further arrangements are requisite in order to secure good management of Government and wards' estates. I am of opinion that, apart from the fundamental necessity for surveys and settlements, it is necessary to train a skilled managing agency likewise. As the Commissioner of Orissa remarks, managers of estates are now selected, not because of any special aptitude for the work, but because of their general respectability, the ideal qualifications for a good manager being general intelligence and smartness at litigation. In some cases managers are selected from the Government services, but they are often selected from other classes also. I think it would be a good rule to lay down that managers should always be selected from the covenanted or uncovenanted services of Government. Men who show aptitude for the work should be specially trained and specially utilized, and when successful specially rewarded. The Bengal Government, it will be remembered, proposed to open a school at Buxar for the purpose of training managers of wards' and Government estates. That proposal has had to remain in abeyance pending sanction of Her Majesty's Secretary of State. In case this school is not finally sanctioned, and indeed if it should be sanctioned also, until such time as it begins to turn out graduates, I would venture to recommend that the Cirencester graduates, who have already returned from England, and those who may return from time to time, may be employed under the Collectors of districts as Deputy Collectors, or as members of the Native Civil Service; that they be attached to, and form part of, the ordinary district staff; and that their services be specially utilized in the management of estates and in making statistical inquiries, and drawing up such reports as may be called for from time to time by Government on subjects connected with agriculture.

Suggested employment of Cirencester students in this capacity.

"I would, as soon as these graduates have acquired some experience of zemindari management, place them in charge of Government estates in the districts to which they may be attached, with instructions to investigate, as far as their other duties permit, the existing systems of agriculture, and to endeavour to introduce such improvements as may be practicable and suitable to the country.

"In short, I would in due time have one of these officers employed as special Agricultural Deputy Collector in each district, and I would have them employed as part of the general district staff subordinate to the Collector, in the same way as the Special Deputy Collector or the Special Sub-Registrar is now subordinate to that officer.

"The Cirencester students are, in my opinion, eminently fitted to be members of the Native Civil Service, or Deputy Collectors, and the advantage of employing them in some such capacity according as they return from England would be, that with little or no additional expense to the State, the administration would in time be leavened with a body of men, interested in agricultural enquiry and improvement, competent to observe agricultural facts and rightly to interpret them, trained in survey and settlement work, and quite above suspicion in point of integrity and ability. These officers, in addition to performing their ordinary duties as revenue officers, might also give special attention to the collection of agricultural statistics and the introduction of

agricultural improvements in the districts to which they may be attached, and it may be hoped that in this way something substantial may be done towards the introduction of improved management within a few years, and of agricultural improvements, if not at once, at least within a generation. When agricultural improvements are introduced in Government and wards' estates, and are shown to be profitable and within the ryots' means, the ryots on other estates will not be slow to adopt them. As an example of what may be done in this way, I would refer to Mr. Sen's annual report.

"It may be asked, if the Cirencester students are employed in the way suggested as part of the general administration, what will there be left for the Director of Agriculture and the special Agricultural Department to do? I would answer—

"*First*—That the Director might, as far as agriculture is concerned, supervise and control the work of the Special Agricultural Deputy Collectors without trenching on the sphere of Collectors, in the same way, though possibly not in the same degree, as the Inspector-General of Registration does that of Special Sub-Registrars;

"*Secondly*—That an Agricultural Bureau would find plenty of work to do in collecting, publishing, and utilizing the information and statistics collected by the proposed Special Deputy Collectors; and

"*Thirdly*—That apart from all this, the Director would have abundant employment in supervising surveys and records of right, as well as in organizing and controlling the establishment requisite for the maintenance of the records when completed."

"The total expenditure involved in sending some thirty-five students to Cirencester in this way would be £3,000 per annum for seven years. The little kingdom of Denmark, with a total area not more than three-quarters of the area of Government and wards' estates in Bengal, spends three times that amount annually in agricultural education; while Belgium, with a total area of less than three-fourths of the area of wards' estates alone in Bengal, spends for the same purpose £15,000 per annum, or more than three-fourths of the total amount which would be required in order to supply within seven years every district in Bengal with a specially trained agricultural officer. France and Germany each spend about fifty thousand pounds per annum on purely agricultural education. If the Governments of Denmark, Belgium, Germany, and France find it wise and prudent to spent large sums in providing agricultural education for the shrewd, intelligent, and well-educated peasantry of these European continental nations, it is surely no waste of public money for a Government like ours, which in all other subjects is deemed to be so much in advance of the people, to spend a small amount in the investigation and development of an industry which, important in every country, in this is vital. In no other country is it supposed that the empirical knowledge of the cultivator is perfect and complete; that agriculture requires no study, or the management of estates no special training or knowledge of agricultural affairs. In this country where everything is new to the governing authorities—the tenures, the crops, the modes of cultivation, the system of accounts—a young Civilian or Deputy Collector fresh from town life, school or college, military men without special training, European planters who may have been unsuccessful at their own profession, and even office clerks and subordinates who may have given satisfaction to their superiors, are found in charge of large estates, which in England would be entrusted to nobody but a trained agriculturist or country gentleman experienced in agricultural affairs. It is not to be wondered at that the results are not always satisfactory. I am therefore of opinion that a beginning should be made, in the way now indicated, in training an agency capable of intelligently observing agricultural facts, and of managing Government estates. Such an agency, with scientific training and the caution that scientific methods impose, would be as averse to reckless and needless innovation on the one hand, as it would be to hasty generalizations and dogmatic assertions of the impossibility of improvement on existing practices on the other. It may be admitted that attempts hitherto made by Government at starting model farms,

and introducing agricultural improvements in Bengal, have not been very successful; but that result is, in my opinion, due to the fact that when the persons in charge of these experiments, such as Scotch gardeners or persons of that class, knew something of agriculture, they knew nothing of India, and were incapable of understanding the habits of the people with whom they had to deal, and of accommodating themselves to them; and when, on the other hand, they were cultured gentlemen capable of understanding the country and the people, they had no knowledge of agriculture, except such as they had acquired as *amateurs* by way of pleasurable relaxation from more serious pursuits. Native graduates, returned from Cirencester after a few years' experience and observation of the agricultural practices and habits of their own countrymen, are not likely to fail in either of these respects. We have no hesitation in saying that our doctors can teach something better than the native systems of medicine, though the native *hakims* are possessed of the empirical knowledge resulting from the experience of all the ages; neither do we doubt that Western science has something to teach the East, in engineering, in law, in the art of government, in those metaphysical and philosophical pursuits which are so congenial to the Oriental mind. We undertake to teach natives the knowledge of their own Oriental languages; we teach them painting, philology, archæology, even riding and athletics; yet, as to agriculture alone, for which science has, within the last fifty years, done as much in Europe as for any other art or business, it is sometimes maintained that Western scientific knowledge can in India do nothing; and this though the art of agriculture as at present practised is more rude and primitive than that described in the earliest records of ancient Rome, though the agriculturist still guides his plough-cattle by twisting their tails, though he has so little appreciation of the value of manure, that he is now allowing bones to be collected and taken gratis from his very door, and to be exported for manure from Calcutta to the Straits Settlements, Mauritius and England, and as though the operation of the laws of nature becomes suspended when a Bengal ryot is concerned with them. My experience leads me to think, on the contrary, when Behar or Bengal ryots are not treated like dumb, driven cattle, and it is deemed worth while to get their *bonâ fide* assent to engagements, that they faithfully abide by those engagements; that, like all poor and hard-worked people, they are keenly alive to considerations of pecuniary gain, and therefore that they will in due time adopt any improvements which are really shown to be profitable and within their limited means. If we had endeavoured during the past century to train up skilled native agriculturists, and to introduce agricultural improvements, in the same way as we have trained native lawyers, doctors, and engineers, it does not appear to me, too much to say, that we should have effected as great reforms in agricultural, as we have effected in other pursuits. The proposals I now make are only a beginning in this direction, and I do not say that they are adequate to meet the necessities of the case. It would appear to me to be much better, to spend lakhs of rupees yearly, in the development of a system of real agricultural education, such as prevails in Germany, France and Italy, than it is to spend large sums in what is now called higher education, or in the construction of bridges, jails, and other public buildings, which, however useful, are not indispensable. I refrain, however, from making any proposals for the organization of an Agricultural Department on any such scale, because I am aware that in the present state of the finances there is no hope of their acceptance."

Chapter II.—Analysis of Districts.

35. The analysis of districts contemplated by the Government of India is described in Mr. Buck's No. 445A, dated 14th May 1885 :—

The examination of each district was recommended with the one object of ascertaining the capability of each tract to pay an unfluctuating rental. But an analysis which seeks to ascertain the requirements of each tract for protection against famine needs much further extension. For this more complete purpose it is necessary to draw up comprehensive statements and series of maps showing the products, distribution of population, grazing area, communications, average rainfall, &c., as well as the irrigation of each pergunnah or kanungo's circle. It is not intended, nor can it be expected, that any such analysis can be effected within any short period. All that the Government of India desires is that some system should be set on foot by the Agricultural Department under which,

as time goes on, such an analysis will be complete. It will consist, the Government of India conceives, mainly in ledgering the statistics of the village records and in reproducing them on pergunnah or district maps.

36. It thus appears, that for the institution of any such analysis as is here indicated, the existence of village records is a requisite preliminary: there being no such records in Bengal, there can be no such analysis. The nearest approach to any analysis of districts, of this kind, would consist in the preparation of such reports for each district, as Mr. Sen has drawn up for Burdwan.

CHAPTER III.—COLLECTION OF REVENUE AND RENTS IN PRECARIOUS TRACTS.

Government revenue in Behar in one sense always precarious.

37. The gross rental of permanently-settled estates in Bengal being at the lowest estimate five times the amount payable by landholders as Government revenue, there can, as a matter of course, be no difficulty in realising that revenue under the sunset law. From this point of view, it may therefore be said, that the realisation of the land revenue is nowhere precarious in Bengal. But there are certain tracts in which, though the permanently-fixed land revenue may be realised, yet the sums realised by Government have had again to be expended, manifold increased, on charitable relief, which became necessary in order to prevent mortality by starvation. Such pre-eminently is the province of Behar, and specially the three northern districts of Durbhunga, Mozufferpore, and Sarun. Within a period of seventeen years there have been five, in which a portion of the people of this part of the province have died of starvation. The whole conditions of agricultural industry there, as already remarked, are such as to render it precarious. It is impossible for the people to fall back in one year of partial failure of crops on the accumulated reserves of a previous year, whether of grain, property, money or credit. Thus in the one district of Durbhunga, which is taken as being the worst of all in those respects—a district which is one of the most fertile, best cultivated and highly favoured by nature in all India—it was necessary for Government to expend in one year,[1] on one famine of 1874, by way of charitable relief, no less than 37 lakhs of rupees in cash, and to expend 118,000 tons of grain, valued in Burmah at nine pounds sterling per ton, thus costing in all, more than one hundred and twenty lakhs of rupees. If to this be added the cost of freight from Burmah, the cost of transport to Tirhoot, and the cost of famine establishment there employed, and the amounts realised by sale of part of the grain be allowed as a set-off against these latter items—a very liberal allowance it will be admitted—it follows that it will not be too much to put down the net cost of famine to Government in this single district, at a crore and a half of rupees, the Government revenue of the district as it then stood, (the boundaries have since been changed) being less than five lakhs per annum. It thus appears that the famine expenditure on this district, in one year, was more than thirty times the amount of the Government revenue, or far more than its capitalised value, so that it would have been a positive gain to the Imperial exchequer, if the district had been made over to Nepal or to any foreign Government, yet the rental of it as shown by the road cess papers, was then no less than twelve times the amount of the Government revenue. Looked at from this point of view, it may be said that the land revenue of tracts of this kind, which are especially liable to famine, and on which a large expenditure may at any time be required for famine relief, is always precarious. But it is not alone on famine relief that enormous sums have had to be expended on this part of country, but there has been also a great outlay on the construction of State Railways, which, though they may facilitate the importation of grain in future times of distress, can in ordinary times be of little benefit to the mass of the peasantry; for it is evident that so long as landlords are permitted to take advantage of the local competition for land in order to enhance rents illegally, it is they, and they only, who appropriate the profits resulting from that

[1] * Mr. MacDonnell's report on food-grain supply, page 71.
Sir Richard Temple's minute, dated 31st October 1874, on Behar Famine, page 26.
Annexure IX,* Mr. Toynbee's report, drawn up for the Famine Commissioners' Report. Statements I and II, Part I, pages 388 and 389.

rise in prices which attends the opening up of means of communication. Besides 200,000 pounds sterling, expended on a temporary famine railway from Barh ghât to Durbhunga in 1874, there has been an expenditure on the Tirhoot State Railway of one hundred and thirty lakhs within the past ten years. Notwithstanding all this expenditure, this is the description which the Collector of Durbhunga had to give of the condition of the people of that district in 1883-84:—

The style of living in Bengal Proper is quite dissimilar. I will, by way of exemplification, direct attention to one incident only which will render my meaning clear. Almost at the very commencement of the cold weather—certainly long before it came to an end—I noticed people, by hundreds sometimes, digging in the field for roots which they gathered for purpose of eating them. Nowhere during my 21 years' service have I noticed such an incident, and had I witnessed it in Midnapore or Dacca, for instance, I would have felt bound to raise the note of alarm at once, in real apprehension of a famine. But here matters are quite different. Every year people eke out the scanty meals that their means allow them to provide for themselves by digging for roots. The circumstance attracts no special attention. It is not necessarily a sign that the poorer classes are in distress. And yet I can vouch for the fact from actual personal experience, that the bread or cake made of this root (*chechaur*) is the most disgusting compound a man can put into his mouth, and medical officers have pronounced it to be most indigestible, utterly devoid of any nourishment, and provocative of the most irritating bowel-complaints. A Bengal ryot, or even labourer, would scarcely throw to a dog what the Behari, even in ordinary times, eats with avidity and apparent relish. The standard of living amongst the two—Bengalis and Beharis—is quite dissimilar.

38. To this may be added the description given by Mr. Norman, the present Collector of Mozufferpore, of the condition of the people of his district. In his administration report for 1885-86, he writes—"Extreme poverty is "undoubtedly the lot of the great majority of the inhabitants of this district, nor "would it be reasonable to expect any other result of a continuous increase in "the population, unchecked by emigration, and untempered by any important "manufacturing industry. There can be no doubt that the unceasing operation "of the partition law in converting the landlords into peasant proprietors, and "thus enabling a larger number of human beings to squat upon the land without "increasing its productiveness, is a factor in intensifying the poverty of the "masses. Another painful concomitant of the sordid and penurious life led by "the Mozufferpore peasant is the general aversion and inaptitude towards "primary instruction, which all officers of the Education Department have to "deplore." One of the effects of these partitions to which Mr. Norman refers has been ascertained by Mr. Collin, the Settlement Officer, tobe that landlords generally enhance rents in the course of these proceedings by the expedient of entering enhanced rents in the partition jamabundis. The ryots in their ignorance submit to the enhancement, under the erroneous impression that these jamabundis, having been officially recognised, are therefore binding upon them.

39. The necessity for famine expenditure in Behar, and the consequent precariousness of the revenue, in my opinion, arise more from the redundancy of population, amounting in some places to nearly nine hundred per square mile, and from the insecurity of tenure, than from any peculiarity in the climatic or soil conditions of that part of the country. In Dacca and the eastern districts of Bengal rents are low, famines are unknown, and demands for suspensions of realisation of Government revenue are unheard of. In Behar, on the other hand, rentals are, judged by Indian standards, excessive, the people are impoverished, and there have been six scarcities, involving the necessity for State aid, within the course of twenty years. Excess of population causes great competition for land; village groves and pastures are being rapidly appropriated for cultivation, the supply of timber for fuel is yearly becoming less, the breed of cattle is deteriorating, and all these evils have a tendency to increase in geometric progression; landlords not unnaturally take advantage of this competition to enhance rents, and thus practically to confiscate the ryot's property. But whatever the cause of this state of things may be, it does not appear to be just to the general tax-payer of India that so much of the imperial and provincial revenues should be expended on a tract, the great bulk of whose agricultural profit goes elsewhere than to the public exchequer.

40. I am far from thinking that a survey and record of rights alone would be a panacea for this state of things. Such operations, which if carried out

at all, should, I think, be entirely paid for by the local parties interested, would be only one step in the direction of providing security of tenure for the agricultural population, and would, in order to prevent things from going from bad to worse, have to be accompanied by encouragement of emigration, by the introduction of agricultural improvements, and by the spread of education so as to raise the standard of living. It is true that all these measures combined would be but feeble palliatives, slow in their operation, and that they cannot be expected to make three acres of land, to support a family of five or six human beings in comfort. But if matters are allowed to drift in Behar, and no measures of this kind are adopted, it is impossible to avoid entertaining a feeling of apprehension, that there must either be great mortality by starvation, or enormous expenditure on charitable relief, in that part of the country, on the recurrence of the first serious failure of crops.

41. *Floods.*—The chief cause of widespread famine and distress in the territories subject to the Lieutenant-Governor of Bengal is drought caused by the premature cessation of the monsoon rains, but the province is also peculiarly subject to floods. It cannot, however, be said that any visitation of this kind has ever caused any general or widespread distress amounting to famine, or that any such calamity has endangered the public revenue. During the period under report floods occurred in Central and South-Western Bengal, and a cyclonic wave swept over part of the Orissa coast. As, however, I was not called upon to take any action in connection with these calamities, no further reference need here be made to them.

Chapter IV.—Measures of protection, including arboriculture and fodder reserves.

42. The question of the growth of trees by road sides, has for some years engaged the attention of District Road Committes, and a good deal has been done in this respect.

Establishment of fuel and fodder reserves.

43. Enquiry had been made by Government, from local officers, before I took charge of my present office, regarding the feasibility of establishing fodder and fuel reserves. The reports received from Commissioners showed that the want of such reserves is much felt in the laterite tract forming the outworks of the hill ranges in the east of the Burdwan Division, and in parts of the Patna and Dacca Divisions, but no practicable measures were suggested by which this want might be supplied. I was directed to report on the requirements, in this respect, of each district separately. This, I have not hitherto been able to do, but having made enquiries generally on the subject, in the course of my tours, and having consulted the Conservator of Forests, I fear that I can suggest no means of generally providing fodder and fuel reserves, which will not be prohibitive on account of their expensiveness. A proposal to turn the Government estates on the Rhotas plateau in the Khymore hills into a reserve of this kind, has been submitted to the Board of Revenue, and is still under consideration.

Chapter V.—Agricultural experiments, including farms.

44. On this branch of the duties, devolving on the Agricultural Department, it was remarked in the Resolution of the 2nd May as follows:—

"The Lieutenant-Governor would also be glad if private persons interested "in the improvement of agriculture would consult these officers either "generally or in regard to special subjects. The special officers are all of "them competent agricultural chemists and trained theoretical farmers, and "their opinion may reasonably be expected to throw some light upon the "suitability of certain soils to certain crops, the employment of improved "agricultural implements, the introduction of better seed and more valuable "staples. It may also happen that their advice will be of benefit on such matters "as the use of manures, ensilage, rotation of crops, simultaneous growth of "several crops in the same field, method of preparing crops for market, and so "forth. Should the adoption of their advice on any point be followed by good "results, the improvement thus introduced would be forcibly brought home to "the people, and would stand a fair chance of gaining permanent ground.

"From this point of view, too, the Lieutenant-Governor would endeavour "to induce intelligent zemindars or ryots in khas mehals, wards' estates "or elsewhere to try such experiments as, after careful consideration, may be "determined upon. If, for example, it is desired to test the merits of a particular "plough, the agricultural officers should induce a selected ryot to plough "half his field with his own plough and after his own fashion, and the other "half of the same field with the new plough and under their directions. If "it should turn out that the crop grown on the area cultivated under the new "method yields more than that cultivated under the old, the cultivator is more "likely to adopt the new method, and others are more likely to follow his "example than they would be if the experiment had been tried on a model farm "and the results recorded in blue books. The fact, however, must be recognised "that cultivators will not be induced to try experiments in this way unless we "are prepared to make good any loss they may sustain by following our advice. "Should it therefore be found practicable to initiate such experiments through "the people themselves, and should such experiments lead to losses, the Lieutenant-"Governor is prepared to make, in a moderate way to begin with, an allot-"ment of funds to meet such losses as may possibly be entailed on ryots or "zemindars by following the advice of the special agricultural officers."

45. The services of three of the Cirencester students who had returned from England, and who had already been engaged in the public service, were accordingly placed at my disposal for employment, among other things, on the prosecution of agricultural enquiries, and in the conduct of experiments in the manner sketched out in the extract just quoted. A small sum was, at the same time, set aside for the purpose of conducting agricultural experiments through the agency of these officers.

46. The total amount thus made available for agricultural enquiry and experiment was Rs. 4,200. With only three officers, and with this small amount available for expenditure distributed among them, hampered moreover by that provisional and limited nature of the sanction accorded to their employment, which rendered it impossible to take any action involving arrangements of a permanent character, it would be unreasonable to expect in one year any very great or striking results.

47. The enquiries and experiments made have not, however, it will I hope be seen, been wholly unfructuous, and a perusal of the reports of these officers will, I trust, show that, while something has already been effected in the direction of agricultural improvement, the results of their enquiries prove that there is good ground to hope that a real Agricultural Department, organized on a permanent basis, might in due time confer substantial benefits on the agricultural population of these provinces.

Reports by agricultural officers.

48. At the risk of making this report unnecessarily voluminous, I think it desirable to annex some of the reports of the Cirencester graduates in the original, as appendices to this report, so that the work done by them may be found described in their own language. The report by Mr. Sen is a specially full, careful, and accurate description of the agricultural system of the Burdwan Division, such as cannot be found elsewhere. It is, I think, worthy of publication on its own merits, and it would not be possible to give an abstract of it in this report. If the agency were available for the preparation of similar reports, for every district in Bengal, it does not appear unreasonable to expect, that great benefits would accrue, by ascertainment of the best and most approved practices of different parts of the country, by the careful examination of those practices, and by intelligent study and consideration of how far the best practices of the more advanced localities may be suited to less enlightened parts of the country, by experimental introduction of such practices in the less progressive localities, and, finally, where such practices are found to be suitable, by active efforts for the introduction of them.

Instances of what has been, and may be, effected by way of agricultural improvements.

49. As examples of what may be effected in this way, it may be here mentioned that Mr. Sen's report shows, that in the Burdwan Division oil-cake is largely used by ryots as a manure in the cultivation of paddy with excellent results, while in many other parts of the country the practice is unknown. Similarly, the system of green manuring by ploughing in a crop of indigo, *sunn*, or *dhainchi*, of which a good deal has been written, is found

to be actually practised by ryots in parts of Burdwan and Hooghly, in the Jamalpore subdivision of Mymensingh, and it may be practised in other places also. Again, the Mauritius system of cultivating sugarcane, the superior advantages of which have been tested by experience and strongly recommended by Messrs. Mylne and Thompson of Beheea, is known and practised on the banks of the Damoodar and among the market gardeners in the neighbourhoods of Dacca and Calcutta. All the practices just mentioned are, on the other hand, unknown in the Bhagulpore and in the greater part of the Patna Divisions A special department, even if it eschewed Western innovations on existing practices altogether, can do much good by introducing in such places as Bhagulpore and Patna, the practices proved by experience to be beneficial in Burdwan or Mymensingh. To take another example of the same thing, it may be mentioned that efforts have, from time to time, been made to improve the quality of Bengal wheat, by introducing seed from Mozufferpnagar and Delhi in ignorance of the fact that the very best wheat in all India, known as Buxar No. 1 club, is largely produced and exported from the Buxar and Sasseram subdivisions of Shahabad in Behar. This species was appraised by the Committee of the Calcutta Wheat and Trades' Association, and was compared with the grain produced in the neighbouring division of Bhagulpore, and found to be four annas per maund superior to the latter in value. The Buxar seed was accordingly introduced into Bhagulpore and yielded a grain, described by the Committee of the Wheat and Trades' Association to be, a "splendid description of wheat—soft, mellow, bold, regular, and of good colour"—and 6 annas a maund superior in value to the local Bhagulpore grain. Applications for some hundreds of maunds of Buxar seed have since been received, from various landholders in the Bhagulpore and other divisions. for experimental cultivation of this species. Here inquiry and knowledge of the facts elicited by it, has shown the way to one very tangible and important improvement. The last instance I propose here to mention of the same kind, will be, in the important matter of the utilization of bone-meal as a manure. The fact was elicited in the course of inquiry, that bones are picked up gratis, and collected throughout many of the districts, by the agents of certain Calcutta firms, who have them ground into bone-meal at Bally and elsewhere. This meal is exported in large quantities for manure, to the Mauritius, Straits Settlements, and even to England. The attention of agricultural officers was called to this trade, than which nothing can be more pernicious to a country so sorely in need of utilising all its manureal resources, and none more clearly illustrative of the failure of the cultivators at all times to appreciate their interests, in all respects. It was suggested that some attempt should be made to awaken the ryots to the knowledge of the manureal value of this article. The suggestion was, as a matter of course, met with the assertion that it was useless to run counter to the prejudices of the people, for Hindus would never use bone-meal because of caste feelings, while Mahomedans could never be brought to see any good in it. Events have falsified these prophecies. Bone-meal was distributed, in small quantities, among selected talookdars in Burdwan, and was used as manure on rice, and other crops, with beneficial results. Brahmins are now glad to take it in their cloths, with their own hands, though perfectly aware of what it is they are taking. The pundits have declared that there is no harm in their doing so. Already small quantities of this manure have been purchased by ryots and talookdars, who have had an opportunity of observing the benefits resulting from the use of it, and Mr. Sen reports that there will be no difficulty in disposing of large quantities of it, for manureal purposes, when the next paddy crop is being sown. I have made these remarks, with a view to show in a general way, the advantages that may be expected from, and the need that there is for, systematic enquiry into existing practices by competent observers. It will, I trust, be apparent from the annexed reports, that the officers conducting these enquiries, as might be expected from gentlemen imbued with the caution that scientific training imposes are as averse to reckless innovation, and to optimistic views of the great improvements on existing practices that they are likely immediately to effect on the one hand, as they are to unenlightened dogmatism regarding the impossibility of all improvements in existing practices on the other. Their reports show that their efforts, though not always made under circumstances calculated to arouse enthusiasm, have not been wholly fruitless, while they hold out promise of the possibility of

much good being effected, if the appointment of these officers, and of others of the same class, be placed on a permanent footing, if they are encouraged and supported by the authorities, and if sufficient funds are placed at their disposal for systematic conduct of enquiry and experiment. With these preliminary remarks, I proceed to take up, in detail, the subjects of agricultural enquiry and experiment, which have engaged attention during the year, premising that I shall treat them very briefly, because they are considered at length in the annexed reports.

Experimental stations.

50. Soon after the creation of the Agricultural Department, the Maharajah of Doomraon expressed his willingness to open a small experimental farm, in his *zirat* land at Doomraon, to be worked under the supervision and in accordance with the advice of Mr. Allen, the Agricultural officer at Patna, on the plan proposed by Mr. Smeaton, the Director of the Agricultural Department of North-Western Provinces and Oudh. The Maharajah of Hutwa expressed his willingness to start a similar experimental station at Sripur in Hutwa. Experiments were also made by Mr. Allen, on the lands of some cultivators at Arrah, and in the Government estates in Buxar. Another experimental station was opened at Burdwan, under the supervision and control of Mr. Sen, in the estates of the Burdwan Raj, now managed by the Court of Wards, and some offers to start similar farms were received from landholders in other parts of the country. Having regard, however, to the limited period for which the Agricultural Department had been sanctioned, and to the novelty of agricultural experiments in Bengal, it was not deemed desirable to start more than a few of these farms, as it was believed that efforts in this direction would only end in disappointment, in case the Department should not finally be put on a permanent footing.

Doomraon experimental station.

51. For the farm at Doomraon the services of a qualified assistant from the Cawnpore Government Farm were secured, and 15 acres of land were set apart by the Maharajah of Doomraon to carry out experiments. Owing to the lateness of the season when work was begun, much could not be done with the rain crops, but experiments with the cold-weather crops were systematic and were attended with marked success.

52. *Rain crops—paddy.*—Nine plots, each covering a standard bigha, were sown with paddy and received the following treatment:—

Plot 1—	Seed broadcasted, unmanured.		
„ 2—	Ditto,	ditto.	
„ 3—	Ditto,	ditto.	
„ 4—	Ditto,	ditto	
„ 5—	Ditto,	manured with cowdung.	
„ 6—	Ditto,	ditto with ashes.	
„ 7—	Ditto,	deep ploughed.	
„ 8—	Ditto,	top-dressed with saltpetre.	
„ 9—	Seeds sown behind the plough.		

53. All the plots that received special treatment gave an increased yield over plots treated in the ordinary way. The plot manured with saltpetre gave the largest outturn both in grain and straw, though it suffered most from water-lodging. The quality of the paddy from this plot was particularly fine, and a sample sent to Barhapur Agricultural Show gained the first prize among a collection made from different parts of Behar and Bengal.

54. *Cold-weather crops*—The chief crop selected for experiment was wheat, the object of the experiments being to ascertain what kind of wheat yielded the best grain, and what manures might be applied with most profit.

55. Fourteen plots, each measuring a standard bigha, were prepared and cultivated in the manner described below. The results go to show that by the application of saltpetre or by ploughing in a green crop, for manure, a largely increased yield and very considerable profit to the cultivator, may be expected. A special report was submitted during the year on the subject of wheat cultivation and trade in the Lower Provinces, and papers were published, in which it was shown that the unclean condition of Indian wheat is due more to

the system of deductions for what is called refraction, than to any defects in the methods of winnowing and threshing.

56. The following tables show the results of Mr. Allen's experiments:—

Number of plot.	Description of wheat.	Treatment.	Remarks.
5A	Local	Deep ploughed	With this wheat was sown a little gram.
5B	Do.	Shallow ditto	
10A	Prize at Doomraon Show.	Irrigated from well	The well was old and the water rich in nitrates.
10B	Ditto	Ditto canal.	
11A	Mozuffernagar ...	Green manured with hemp ...	The hemp was ploughed on 15th September.
11B	Ditto ...	Unmanured	
12A	Ditto ...	Manured with ashes, 1 maund.	
12B	Ditto ...	Ditto ditto, and top-dressed with saltpetre.	One maund of crude saltpetre mixed with an equal weight of dry earth.
12C	Local	Manured with Rs. 2 worth of cowdung.	
12D	Do.	Unmanured.	
12E	Buxar	Top-dressed with saltpetre, November 29th.	Ditto ditto ditto.
12F	Do.	Unmanured.	
13A	Mozuffernagar ...	Ditto.	
13B	Local	Ditto.	

57. The outturn in grain and straw per acre is given below—

Number of plot.	Grain per bigha.	Straw per bigha.	Grain per acre.	Straw per acre.
	lb	lb	Mds. srs.	Mds. srs.
5A	439	698	16 7	25 29
5B	374	602	13 31	22 8
10A	382	460	14 3	16 38
10B	243	307	8 38	11 13
11A	736	1 002	27 6	36 38
11B	422	598	15 22	22 2
12A	545	602	20 4	22 8
12B	631	607	23 11	22 15
12C	501	608	18 19	22 17
12D	372	458	13 28	16 35
12E	739	1,702	27 10	62 31
12F	383	469	14 5	17 12
13A	416	348	15 13	12 33
13B	344	491	12 27	18 4

58. Plots 5A and 5B show the advantage of deep ploughing over shallow ploughing in case of wheat. Contemporaneous experiments made at Arrah did not support these results, but in Sripur deep cultivation gave in one case 22 and in another 13 per cent. increased yield over similar plots shallow ploughed.

59. The results in plots 10A and 10B, would indicate, that well-water is far superior to canal water, but in comparing the outturn of these two plots, allowance must be made for the better quality of the soil of 10A, and the unusual richness in nitrates of the well-water with which it was irrigated. Compared with 12D, which was also canal irrigated, the advantage due to well-water is reduced to 15 seers of grain per acre.

Plots 11A and 11B show the great advantage of green manuring. The outturn is very nearly equal to that of the best plot top-dressed with saltpetre. These results have been fully supported by the experiments made at Arrah.

As regards the yield in grain, the different varieties of wheat tried at Doomraon come in the following order:—(1) Mozuffernagar, (2) Buxar, (3) white and (4) red; but if we consider the straw only, the order is—(1) red, (2) Buxar, (3) white, and (4) Mozuffernagar.

The outturn from plot 12E, which was top-dressed with crude saltpetre at the rate of one maund per acre, is exceedingly satisfactory. A yield of 27¼ maunds of grain, which was found to be equal to 34⅓ bushels per acre, would be considered a very good crop even in England. This plot also gave the largest outturn in straw.

The following table shows the approximate cost per acre of each special manure, the excess in grain and straw resulting from the use of it, and the net

profit, taking the value of grain at two rupees and of straw at four annas per maund :—

Treatment.	Cost.	Grain.	Straw.	Net profit.
	Rs. A.	Mds. srs.	Mds.	Rs. A. P.
Green manuring	8 8	12 0	15	19 4 0
Ashes	6 13	4 20	.....	2 3 0
Ashes and saltpetre	15 0	7 20	.....	*Nil.*
Cowdung	6 3	4 20	2	3 5 0
Saltpetre alone	9 6	18 0	45	27 14 0

60. *Sugarcane.*—Some experiments with sugarcane were also made by Mr. Allen, in order to ascertain the comparative merits of the native system of planting cane, and of that known as the Mauritius system. The results of these experiments cannot be stated till the middle of the next winter.

Burdwan Raj experimental station.

61. On the recommendation of the Managers of the Burdwan Raj, supported by the Court of Wards, the Government of Bengal sanctioned the opening of a small experimental station at Burdwan, the term of the experiment being limited to two years, and the expenditure from the funds of the estate to Rs. 1,000 per annum.

Owing to the lateness of the season when the work was commenced, and to the fact that the land of the farm consisted of a neglected plot of ground overgrown with weeds and jungle, which therefore had to be brought under the plough for the first time, the number of experiments conducted during the year under review was limited.

62. *Potatoes.*—Experiments were undertaken with potatoes on this farm, with a view, to ascertain the comparative merits of different manures, as well as of different varieties of potato. English potatoes were imported and planted in the farm, in order to ascertain. whether they can be grown with success in the plains. The seeds were planted at least one month after the proper time of putting them in.

Country seeds were planted whole, but of English and hill potatoes cut sets alone were used. The mode of cultivation followed is that prevalent in the Hooghly and Burdwan districts, and described in Mr. Sen's report under the head potatoes. The crops were irrigated with canal water once every ten days.

(1) *Country Potatoes.*

Manures applied per acre.			Price of the manures per acre.	Outturn per acre in lbs.
			Rs. A. P.	
(1) Bone-meal ...	360	lbs.	40 8 0	6,787½ lbs
Super	240	„		
Saltpetre ...	240	„		
Gypsum ...	240	„		
(2) Oil-cake ...	240	„	37 8 0	4,320 „
(3) Super ...	480	„	39 8 0	7,920 „
Saltpetre ...	240	„		
Gypsum ...	240	„		
(4) Bone-meal ...	480	„	36 0 0	3,984 „
Saltpetre ...	240	„		
Gypsum ...	240	„		
(5) Bone extract ...	600	„	39 0 0	4,200 „
Saltpetre ...	240	„		
Gypsum ...	240	„		
(6) Oil-cake ...	2 400	„	44 4 0	960 „
Saltpetre ...	72	„		
(7) Super ...	480	„	39 8 0	6,480 „
Saltpetre ...	240	„		
Gypsum ...	240	„		
English potatoes.				
(1) Oil-cake ...	2,400	lbs.	37 8 0	8,713½ lbs
(2) Super ...	480	„	48 12 0	10,440 „
Oil-cake ...	720	„		
Saltpetre ...	240	„		

Different varieties under the same treatment.

Varieties.	Outturn per acre in lbs.
1. English	10,440 lbs.
2. Darjeeling	9,288 „
3. Country	6,787½ „

The English potatoes were got from Messrs. Sutton and Son of Reading. They were obtained in excellent condition and gave most healthy plants, showing no signs of blight. Small quantities of the seed were distributed among ryots for planting, side by side with the country seed, and in every place where they were tried the English proved to be superior to the local varieties. They gave not only an increased outturn as compared with local varieties, but the tubers were also much superior to those obtained from country seed. It has likewise been found that potatoes got from the English seed are superior, as regards keeping qualities, and Burdwan ryots are now purchasing the English seed from Mr. Sen at cost price.

63. *Wheat experiments in Burdwan farm.*—Two varieties of wheat were tried, viz., Buxar wheat (club No. 1), and the white wheat from Mozuffernagar. The seed was broadcasted at the rate of 10 seers per bigha, and the plants were twice irrigated with canal water. Bone-meal was used as a manure, being spread broadcast at the time the seed was being sown. The Mozuffernagar wheat was soon attacked by rust probably imported with the seed, while the Buxar wheat, grown side by side with it, was quite free from the disease. The results of the experiments are given below:—

(*a*) *Buxar* (*club No.* 1).

Manure used.	Outturn.
(1) Bone-meal, 480lbs	1,080 lbs.
(2) No manure	480 „

(*b*) *Mozuffernagar wheat.*

(1) Unmanured	600 lbs.

In quality the Buxar wheat was very much superior to the Mozuffernagar. The grain of the latter grown in Burdwan became reddish in colour, small in size, and apparently diseased.

64. *Gram.*—Three plots of gram were sown, and of these one was manured with bone-meal, another with bone extract, and the third plot was left unmanured.

The results of the experiments are given below:—

Plots.	Manures used per acre.	lbs.	Cost of manures used. Rs A. P.	Outturn per acre. lbs.	Money value of extra yield. Rs.
1.	Unmanured ...	... ..	.....	680	.....
2.	Bone-meal ...	240	6 0 0	1,320	16
3.	Bone extract ...	240	4 8 0	1,200	13

65. *Mangold, Sugar-beet and Turnips.*—These crops were tried with a view to ascertain if they can be profitably grown as fodder crops:—

Mangold.

	Manure used per acre. lbs.	Outturn per acre. lbs.
Super	240	14,400
Saltpetre	120	
Hide salt	240	
Gypsum	120	

Sugar-beet.

	lbs.
The same manure	12,000

Turnips.

	Manure used. lbs.	Outturn per acre. lbs.
Bone-meal	240	13,000

66. *Sorghum, yellow Cholum and Reana Luxuriens.*—These crops were grown as cold-weather crops in accordance with a suggestion of Dr. King.

	Outturn per acre.
	lbs.
Sorghum	9,600
Yellow cholum	14,000

Reana was tried and failed. All these crops made very little progress through the winter, and even the outturn given above would not have been obtained but for a heavy shower in March.

Mr. Sen thinks that the results of these experiments go to show, that sugar-beet and turnips might be successfully grown as fodder crops; that sorghum and yellow cholum will not succeed as cold-weather crops, but subsequent experience has shown that they do well as rain-crops.

67. *Ensilage.*—Mr. Allen made some experiments under this head. He tried only pit silos. The results of his experiments are given below:—

Name of the place where the experiment was tried.	Nature of the silo.	Nature of the fodder stored in.	Nature of the silage.
Doomraon	(1) In strong clay soil ...	Grass	Poor.
	(2) Ditto ...	Chopped janera ...	Very good.
	(3) With masonry walls	Grass	Not good.
	(4) In loamy soil ...	.....	Ditto.
Gya	In stiff clay ...	Chopped janera and green paddy.	Exceedingly good.
Patna	In clay	Grass	Fair.
Buxar [By Mr. Jenkins]	.....	.....	Fair.
Arrah [By Mr. Power] ...	Over ground ...	Grass	Not yet opened.
Beheea [By Mr. Burrows]	Ditto	Grass	Not good.

68. On the question of how far ensilage may be generally had recourse to, with advantage, in Behar, Mr. Allen says:—

The only stuff fit for ensilage is, in my opinion, fodder that cannot otherwise be preserved. So I would silo the first cuttings of grass during the rains, or a crop of oats that had come on too fast, and which would lodge before it ripened if left alone. Similarly in Behar there is generally a great deal of *makai* and *janera* which is ruined by excessive rain or floods. If this could be cut and stored in a silo before it had begun to spoil, ensilage would be economical. In some years like the one under review, when the rains cease early, a great deal of paddy might be utilized which is now wasted. The crop has reached the flowering stage and looks splendid, but there the growth is checked owing to a want of water. The ears can never fill, and such crops are now usually grazed down, but if cut, as was done in Gya, and then stored, ensilage is decidedly beneficial. On the whole, *janera*, which is always cut green, because the stalks become too woody even for buffaloes, if left to grow, is the best crop in Behar for ensilage. The fodder should be cut into small pieces, which will pack much better than if stored uncut, and then the cultivator can have green food for his cattle in May, which will enable him to save his *rubbi* bhoosa for the months of greatest scarcity—November and early December.

On this question Mr. Sen thinks that in the widely cultivated districts, in which the want of fodder is greatest, there is no surplus grass at any time available for ensilage; that if there were such surplus, it can be best preserved in the ordinary way as hay; but he also thinks that special fodder crops, such as sorghum, yellow cholum, makai and janera, might be profitably grown in the rainy season and preserved in silos for the hot and cold weather months when the scarcity of fodder is most felt. I am inclined to agree with these views, but think it premature to express a final opinion on the subject.

69. *Manure experiments by Mr. Hossein.*—Mr. Hossein tried three manures, viz., bones, nitrate of soda, and saltpetre. Bone-meal applied to wheat did not give an increased yield, but this manure gave satisfactory results applied to potatoes, while it was positively injurious to cabbages.

Nitrate of soda—This manure does not seem to have had any very great effect in increasing the yield of paddy.

70. *Sorgho.*—As a winter-crop sorgho failed in Bhagulpore. Of the fodder crops, Guinea grass gave the best results in that division.

71. *Experiments through ryots and talookdars.*—A number of manure experiments were made by Mr. Sen through the ryots and talookdars of Burdwan.

Manures were used on paddy, sugarcane, and potatoes—the three most important crops of the division.

72. *Paddy.*—Under the conditions on which these manures were tried it has not been found possible to give quantitative results. Oil-cake and superphosphate of lime gave better results than oil-cake and hornshavings. The addition of saltpetre to oil-cake gave an increased yield over oil-cake alone. At Halsimul hide salt applied at the rate of 60lbs. per acre, and costing only 15 annas, gave a yield equal to that given by the same quantity of saltpetre costing Rs. 5-10.

73. *Sugarcane.*—Some bone manures applied to sugarcane are said to have been greatly appreciated by the cultivators, but no quantitative results have been given.

74. *Potatoes.*—English and Darjeeling potatoes were tried by ryots and talookdars in some twenty villages.

The result seems to have been satisfactory to the cultivators, for applications have lately been made for the purchase of 50 maunds of English and Darjeeling potato seed, by ryots and talookdars of these villages.

Buxar wheat and white linseed were distributed among ryots in over 40 villages, and gave a better yield than the local varieties.

75. At Arrah Mr. Allen made some wheat experiments through cultivators on the Government estate, the results of which will be found tabulated in his report. Saltpetre applied as a manure to wheat resulted, it is reported, in a net profit to the cultivator of Rs. 15 per acre.

76. At Sripur some few experiments, of no great importance, were made under the supervision of Mr. Buskin, Manager of the estates of the Maharajah of Hutwa. The results are given below—

	Deep ploughed.		Shallow ploughed.		
	Mds.	s.	Mds.	s.	
Buxar wheat	3	15	2	30	The plots contained half a bigha each.
Mozuffernagar	3	10	2	35	

Both Mr. Hossein and Mr. Sen are of opinion that accurate results, for scientific purposes, cannot be obtained from experiments made through private individuals, whether ryots or talookdars, though experiments conducted in this way, when successful, may be useful in order to bring home to the people a knowledge of their results and I agree in this opinion.

77. *Nankin cotton.*—It having been brought to notice that a species of indigenous khaki-coloured cotton is grown in Durbhunga, Chittagong, and Hill Tipperah, it was thought that the cultivation of Nankin cotton would be most likely to succeed in these or on the neighbouring districts. Arrangements have accordingly been made for the experimental cultivation of Nankin cotton in Mozufferpore, and Hill Tipperah. It has been found that this cotton can be grown with success in the Government estate of Khoordah in the Orissa Division. It cannot, however, the Commissioner reports, be produced, except on a very large scale, at less than six annas per pound; while the Government of India are not prepared to offer more than four annas per pound for the cotton of approved quality delivered at Buxar.

78. *Silk.*—When the announcement was made that an Indo-Colonial Exhibition was to be held, the Government of India was reviewing the various products of the country, with a view to determine which product might be most likely to reward efforts for the promotion of their development, and decided that silk was the product of which there was most hope. By the mutual wish of the Government of India and of the Royal Commissioners, Mr. Wardle came to India "to give encouragement to the extended production of tussur silk, to collect "samples of the wild and domesticated silks of India, and to see how it was "that Bengal silks had fallen into disrepute within the last twenty-five years."

Mr. Wardle visited various filatures in Rajshahye and Moorshedabad, and showed that the fibre of Bengal silk might be preferred in several respects to the Italian, if properly reeled, and he attributed the decline in mulberry cultivation to the high and differential rates of rent charged for mulberry lands, the low prices of the silk market, the failure of the cocoon crops due to bad seed selected by native breeders, and to the introduction of more profitable staples. He suggested that Government should rear cocoons for seed purposes, and should set an example to private zemindars by reducing the rent

for mulberry lands in its own and in wards' estates. The practice of assessing land according to produce, and not according to the capabilities of the soil, was condemned in 1837 by the Court of Directors, who remarked that it must act as a check on industry, and discourage cultivation. The Board of Revenue have always condemned the practice and in their rules drawn particular attention to importance given to the orders of the Court of Directors by the rapid extension and growth of new staples. Enquiries are now being made in the mulberry-growing districts, as to whether high and differential rates of rent, have generally had any effect on the silk industry, and a report on the subject will soon be submitted.

Chapter VI.—Cattle-breeding and veterinary establishments.

79. A scheme was prepared by a committee appointed by the Lieutenant-Governor for the establishment of a veterinary school in Bengal, and proposals on the subject were, during the year, submitted to the Government of India. This was intended as the first step in the direction of providing an agency, for collection of the information, requisite to enable Government to take action, for improvement of the breeds of cattle in Bengal. The Government of India, was, however, unable for financial reasons at present to accept these proposals, and nothing more in this direction could therefore be done. It is hoped that it may be found possible to take up the question again when the arrangements for the provincial contract have been completed.

Chapter VII.—Agricultural and fiscal statistics.

80. The difficulties that lie in the way of collecting agricultural statistics in Bengal have been frequently described, and it would serve no useful purpose to repeat the description of them here. It was suggested during the year that an attempt might be made to collect statistics of the area sown under wheat in the Bhagulpore and Patna Divisions through the agency of existing putwaries. The local authorities represented, however, that trustworthy statistics could not be collected in this way, and the attempt had accordingly to be abandoned. Rough estimates of the areas under jute were prepared.

Collectors of districts were asked to report how far the information requisite in order to fill up the forms approved by the Statistical Conference held in Calcutta at the time of the Exhibition might be furnished for Bengal without a cadastral survey. It appears from the reports received that, while some of these forms can be filled up without a cadastral survey, the information requisite to fill up others cannot be furnished.

Price lists under the Tenancy Act.

81. One of the special subjects bearing on agricultural statistics, to which my attention was directed in the Resolution of the 2nd May, is the question of the market prices of staple food-crops. "Another matter," the Bengal Government remarked, "falling under the head of agricultural research, to which the "Director is to give his attention, is the question of market prices of staple "food-crops. To the accurate investigation and record of prices current a "new and special importance attaches since the passing of the Tenancy Act. "Under sections 32 and 38 of that Act, a rise or fall in prices is made one of "the grounds for a corresponding enhancement or reduction of rents; the "courts, in determining the amount of rise or fall in prices, will in future be "bound to refer to the price lists prepared under the Act, and further, they "will have to presume such lists are correct till the contrary is proved. On "the accuracy of the prices recorded in the lists will, therefore, chiefly "depend the fairness or otherwise of the amount of enhancement or reduction "of rents which the courts will in future award; and, looked at from this point "of view, it will thus be seen that the importance of securing accurate returns "of the price of staple food-crops can scarcely be exaggerated."

In accordance with these instructions the standing orders on the subject of compilation of price lists of food-crops were reviewed under the Board's guidance in a circular letter No. 57-63, dated 8th June 1885, addressed to all Commissioners. Suggestions were made as to the manner in which lists

should be prepared under the Tenancy Act, and criticism or further suggestions were invited. On receipt of the criticisms and reports of Commissioners, rules were framed and published in the Gazette for public criticism. Objections to these draft rules were received from various individuals and local bodies, and were considered by a committee appointed by Government for the purpose of making rules under the Tenancy Act. After such consideration, the rules were finally published, and came into operation with legal force and effect on the 5th May 1886. Price lists under these rules are now being prepared for submission to Government and publication in the Gazette. It has not been found necessary to employ any additional establishment for the preparation of the lists, and no objections have anywhere been made to them when published. In the last resort the real safeguard for the accuracy of these lists must be, in the care and trustworthiness of the officers who prepare them.

Chapter VIII.—Trade and Trade Statistics.

82. The compilation of trade statistics has not been taken over from the General Department of the Secretariat by which such statistics continue to be prepared.

Chapter IX.—Miscellaneous.

Agricultural Exhibitions.

83. The agricultural exhibitions which have been held during the period under review are the following :—

I.—An Agricultural Exhibition was held at Doomraon on the 15th February 1885.—This exhibition was organized by Mr. Nolan, the Collector of Shahabad, and a Committee of local gentlemen, official and non-official, with Mr. T. L. Jenkins, C.S., Sub-divisional Officer of Buxar, as Honorary Secretary. The show originated in a desire on the part of the Maharajah of Doomraon to exhibit to the cultivators on his estate the latest improved agricultural implements, and the best agricultural products. The Maharajah made a contribution of Rs. 2,500, and guaranteed the Committee from any loss, provided an equal amount was raised by other private subscriptions. Government also made a grant of Rs. 1,000 to the Exhibition.

This was the first show of the kind ever held in South Behar; and judging from the number of exhibits received from neighbouring districts in North and South Behar, and from the North-Western Provinces, and from the gathering of cultivators and the interest they took in the show, it may be considered to have been a very successful one.

One useful result which followed the Doomraon Agricultural Exhibition was that the Maharajah of Doomraon, with a laudable desire to test the value of improved methods of cultivation, opened out on his *zirat* lands the experimental farm already described.

There was considerable competition in exhibits of grain, millets, pulses, and oilseeds.

The ryots at the Exhibition asked for samples of the best varieties of some grains which were not produced locally, viz., white varieties of linseed, gram, janera, and peas and some fine qualities of paddy. They also took much interest in the awards for wheat, and on the recurrence of a similar exhibition last cold weather in the neighbourhood at Barrahpur, some of the ryots who had received prizes at this exhibition, but failed to do so at Barrahpore, questioned the propriety of the awards and seemed to be keenly interested in the results. If these Exhibitions are continued, and the cultivation of the better kinds of grain is thus fostered in Shahabad,—the district which has taken the lead of all others in attempts at agricultural improvement,—the cultivators on Government estates may be induced to grow *pedigree* wheat for seed alone.

84. II.—An Exhibition was held at Kissengunge in Purneah district from the 11th to the 21st January 1886.

The agricultural products exhibited were mostly brought from the subdivision of Kissengunge itself, a small portion only coming from Purneah. Hill potatoes grown from seed obtained during the year from Revd. Mr. Wilson,

of Rangaroon, near Darjeeling, were exhibited and compared very favourably with the local varieties. The practical result of this comparison was that the cultivators of the sub-division generally are trying to get seeds of the imported quality of potatoes; and as the sub-division grows this crop very largely, this result is reported to have been beneficial. Prizes for country products of various kinds were given by several of the most influential native gentlemen of the subdivision.

The local Committee have for many years past been trying to introduce improved ploughs into this subdivision, and their efforts have to some degree been successful.

Axes, sickles, and bill-hooks exhibited by Messrs. T. E. Thomson & Co. found a ready sale, and were, it is reported, much liked by all persons who purchased them.

85. III.—An Agricultural Exhibition was also held in the Perozepore subdivision of the Backergunge district from the 9th February to the 9th March 1886. This Exhibition was organized without European supervision of any kind; it was initiated and arranged by the Deputy Collector, Baboo Soshi Seekhur Dutt, and appears to have excited interest among the people of the subdivision.

The subdivisional officer collected a number of cultivators, and showed them the Barrakar and other ploughs at actual work. Some of these ploughs were also distributed as rewards to the ryot exhibitors of grain.

86. The Collector gave away silver medals and money to the amount of Rs. 1,000 as awards. This money was raised by private subscription, the Exhibition having been spontaneously organised without assistance from Government.

IV. At Noakholly an Exhibition was held, which lasted from the 4th to the 10th March 1886 inclusive. Mr. Sen, of the Agricultural Department, was present and reported that this Exhibition was not altogether successful.

The collections of grains and pulses were good. Green vegetables were fairly represented. The live-stock section, which was expected to have been a great success, was almost a complete failure, the people of that part being, Mr. Sen says, so superstitious that they were unwilling to expose their best cattle to the gaze of the public lest they be overlooked by the evil eye.

A quantity of sugarcane was collected to work with the Beehea mill; and Mr. Sen was asked to show the process of *gur*-making in the presence of the people attending the Exhibition. The first *chaki* of *gur* made was of inferior quality, owing to the presence of acids due to fermentation. The quality of the juice was, however, perceptibly improved by mixing a quantity of soda with it. The experiment excited considerable interest, and all who were present admitted that they had no idea that *gur* of such good quality could be made in Noakholly.

Mr. Sen also showed the Barrakar and the Duplex ploughs at work, but the bullocks of the district generally are, he reports, too weak to work these ploughs.

This Exhibition was very numerously attended, and the Collector, Mr. Waller, took much trouble in organising it.

87. V.—An Agricultural Exhibition was held at Barrahpur near Doomraon at the end of February 1886, and as I was present at it myself, I can testify to its having been a successful one. It was largely attended; the ryots took much interest in the proceedings. Mr. Power, the Collector, Mr. Jenkins, the Subdivisional Officer, Mr. Allen, and the Executive Committee took great pains in organizing this Exhibition, which they attended at much personal inconvenience. It was held in connection with a local *meld* in a somewhat out-of-the-way place, and was not accompanied by any of the social festivities which sometimes make these gatherings attractive.

Agricultural Implements.

88. *Ploughs.*—The question of supplying an efficient and at the same time a cheap soil-inverting plough engaged attention. It was suggested to agricultural officers that the cast-iron works at Barrakur might with advantage be utilised for this purpose. A cast-iron plough was accordingly made at

these works under instructions from Mr. Sen and other officers of the department, aided by the Superintendent, Ritter von Schwarz. This plough, costing only Rs. 2-12, is cheap and fairly efficient: it has been favourably received by ryots especially in the neighbourhood of Burrakur, who have seen it used. Five hundred and sixty four of these ploughs have been purchased by ryots, and applications for four hundred more have been received. Two Behar planters who were supplied with specimen ploughs for trial, have reported themselves satisfied with them and have each ordered fifty.

Mr. Hossein, the agricultural officer of Bhagulpore, made a wrought-iron plough, which works fairly well, but is of somewhat flimsy construction.

It has lately been found possible to obtain a much better plough than either the Burrakur, or the Bhagulpore plough, by combining part of Mr. Hossein's improved Bhagulpore plough, with the frame work of the Barrakur plough and with a new contrivance invented by Mr. Sen for raising and lowering the beam. This plough is now being made at Sibpore, and promises to be a really useful implement in the hands of Bengal ryots. It will cost about Rs. 4-8, and will, I hope, command a large sale among ryots and others. The Hindustan plough was tried at the Agricultural Show at Kissengunge, and was much liked by ryots. Over one thousand of these ploughs were disposed of during the year in Bengal. This is an excellent plough, but, being priced at Rs. 12-8, is much beyond the means of an ordinary ryot.

It will thus be seen that, though it has not been thought right to give any special encouragement to the sale or use of the Burrakur, or of any other ploughs pending more careful and more lengthened testing of their merits, yet more of these improved ploughs have been sold in Bengal in this one year than have been sold of the Cawnpore or other improved ploughs in the North-Western Provinces in ten years—a fact which is noted as tending to show that there is no part of India in which the ryots are more intelligent, and therefore more willing, to adopt anything which is really an improvement, and none where the need is greater for a special agency for introduction of such improvements.

Water-lifts.

Efforts are also being made at Burrakur to devise an efficient and cheap water-lift, after the Cawnpore model, under the direction of Ritter von Schwarz, who has given me very valuable aid and advice in these matters.

In accordance with the orders of His Honour the Lieutenant-Governor arrangements have been made for exhibiting the best agricultural implements during the coming cold weather at *melâs* where cultivator's largely congregate.

Indo-Colonial Exhibition.

89. Owing to the number and variety of the other subjects to be dealt with, it was not thought desirable to burden the Agricultural Department with all of the work that arose in these provinces in connection with the London Exhibition. A committee, of which I was a member, was therefore appointed, and was generally charged with this work. Collections of agricultural implements were, however, made by this department and handed over to the Executive Committee. A collection of raw leaves of tobacco and of the various preparations of that plant was also made and delivered to the Committee.

Mr. Allen acted as Secretary to the Branch Committee at Bankipore, and Mr. Sen helped the Collector of Burdwan in making his collection of exhibits.

Co-operation of the Agri-Horticultural Society of India.

90. In the Resolution of the Government of Bengal, dated the 2nd May 1885, it was stated that as the Agricultural Department existed only on the basis of a provisional sanction, it would be desirable to trust to some extent for useful action in the way of agricultural improvement to the co-operation of established societies interested in the matter. Arrangements were accordingly made to place the Director on the Council of the Agricultural and Horticultural Society of India. The good offices of the Society were at the same time secured in furthering the usefulness of the Economic Museum, by the exhibition of trade samples of products in the Society's rooms in the Metcalfe Hall.

The Society having represented that they should be provided with funds to enable them properly to co-operate with the Agricultural Department, the

Government subsidy to them was increased from Rs. 2,400 to Rs. 6,000 a year. In consideration of this increased grant, they undertook to take charge of and place in their rooms such articles as the Government might wish to deliver into their custody, and to conduct such experiments in economic products as might from time to time be suggested and considered desirable. To give effect to this latter part of the arrangement, a scheme has been drawn up, in communication with the Council of the Society, for the conduct of certain agricultural experiments through some of its members

The experiments which it is proposed to have tried in this way are the following :—

I.—Experiments designed to test the effects and economic results of the application of certain manures, namely—

(*a*) Saltpetre | (*c*) Oil-cake.
(*b*) Bone-meal. | (*d*) Cow-dung.

II.—To test effects of green-manuring by ploughing in a crop of *sunn, dhaincha* or indigo.

III.—To test effects of early ploughing as contrasted with late ploughing and of using soil-inverting ploughs as compared with common country ploughs.

IV.—Introduction of Baxar wheat where other species of wheat are now grown.

Selected members of the Society who make these experiments will report the results, and where they are found satisfactory will, it is hoped, endeavour to follow up the experiments by efforts for the introduction in their several neighbourhoods of the improvement suggested by them.

Samples of various economic products, amounting in all to 650, were transferred from the Economic Museum to the Society's room in Metcalfe Hall. A large number of these were damaged, and it is intended to renew them as the seasons for the different grains come round. These grains will be divided in the qualities known in the market: their prices may be annexed, and spare samples may be supplied to local museums in the mofussil, or in other places where cultivators may have access to them, and may thus be in a position to see the relative values of different grains for themselves. The Society will also give useful assistance by examining samples to which prizes may be awarded in local exhibitions, and indicating whether the prizes have been given to the best exhibits, thus helping the judges to award prizes, to the really best exhibits at subsequent exhibitions.

91. *Fibre experiments.*—At the request of the Government of India some experiments were conducted by the Society in the cultivation of fibre plants and extraction of fibre. The results have not been yet reported.

92. *Forecasts of crops.*—A forecast of the current year's jute crop was prepared and published in accordance with the orders of Government and in response to a call made by the Secretary of State for statistics of the area cultivated under that crop. The forecast was based on reports received from 211 non-official persons, consisting of zemindars, merchants, and planters; and is said to have been of some use to persons interested in the jute trade. It is intended to prepare similar forecasts of the coming wheat crop.

93. *Miscellaneous questions connected with introduction of the Tenancy Act.*—A considerable portion of my time was, during the period under review, devoted to the preparation of rules for survey and record of rights under Chapter X of the Tenancy Act, to the revision of the settlement chapter of the Board's rules, and to the consideration of various other questions connected with the introduction and working of the Tenancy Act.

94. In concluding this, the first, and, as I fear it may also be, the last annual report of the Agricultural Department in Bengal, I would add that I am conscious that very little has been done during the period under report, compared with the vastness of the field for work, and with the magnitude of the requirements of the case; but in estimating the measure of progress made, it will doubtless be remembered that the officers of this Department have been labouring under conditions of peculiar difficulty. It is not alone that the temporary character of the sanction accorded to the existence of the

Department rendered it impossible to take any action, involving arrangements of a permanent nature, but the subjects dealt with are new in Bengal, and it is difficult to arouse interest in them. Without the co-operation and support of local authorities, officers of a special department cannot effect much in the way of agricultural improvement, and it is therefore the more incumbent upon me to acknowledge with thanks the encouragement and support received from local authorities generally, but especially from Mr. Halliday, Commissioner of Patna, Mr. Nolan, the late Collector, and Mr. Power, the present Collector of Shahabad, Mr. Quinn, Collector of Patna, and from Mr. Jenkins, Sub divisional Officer of Buxar; also from Mr. Waller, Collector of Noakholly, and Mr. Fasson of Backergunge. Among zemindars, thanks are due to the Maharajah of Doomraon, to his Manager the Hon'ble Jai Prakash Lal, to Moulvi Fazl Imam of Patna, and to Mr. Burrows of Beheea.

95. Of the officers who worked under me, Mr. Collin showed much tact, sound judgment, and good sense in the conduct of the settlement operations in Mozufferpore. Mr. Allen worked with much zeal and energy, and is an officer of much ability. Mr. Sen is a modest and unassuming, but an able, industrious, and sensible officer. Mr. Hossein did not receive much local encouragement. He is willing and energetic, and, with a little more experience, will be a useful officer.

I have the honour to be,

SIR,

Your most obedient servant,

M. FINUCANE,

Director of the Agricultural Department, Bengal.

PART II.

APPENDICES I—IV.

SECRETARIAT LIBRARY

APPENDIX I.

No. 312, dated Bankipore, the 4th August 1886.

From—D. B. ALLEN, Esq., C.S., Assistant to the Director of the Agricultural Dept., Patna Division,

To—The Director of the Agricultural Department, Bengal.

I HAVE the honour to submit the report called for in your No. 198 of the 27th May. I was appointed your Assistant on the 11th May 1885.

2. The general system on which I was to work was arranged in consultation with Mr. Hewitt, the Officiating Commissioner of the Division, when you visited Bankipore on the 13th idem. A telegram received on the 19th informed me that I was posted to Bankipore, and that I might at once begin the preliminary enquiries which seemed to be essential before I could decide where and how I should begin the new work that had been entrusted to me. About a fortnight was spent in these enquiries, during which I visted the districts of Gya, Sarun, and Mozufferpore, and also Allahabad and Cawnpore. During this time I consulted those whom I thought best qualified to advise me, both officials and non-officials, Natives and Europeans. *Inter alios* General Macpherson at Allahabad was good enough to show me his silos and the means he used for reclaiming waste land; and Major Pitcher at Cawnpore showed me over the Government farm, and explained the methods adopted by the Agricultural Department of the North-Western Provinces for improving the state of agriculture. I may add that before joining my appointment I had spent two days with Mr. Ozanne, Director of Agriculture in Bombay, and learnt from him the kind of work on which he was employed. On my return to head-quarters I had to start the office, and helped by the printed instructions with which you favoured me, and by numerous reports and circulars I was enabled to begin regular work. In addition to purely agricultural work I had to take charge of one or two Government estates, and after consulting the Collectors concerned I was put in charge of the Pichasa estate, a purely rural village near Behar, in the Patna district, and the urban estate of Arrah, in the district of Shahabad.

The nature of the work connected with the estates must be referred to here in so far as the superintendence of these estates enabled me to study the ordinary native systems of agriculture with a view to introducing practical improvements. By conversing with cultivators, village officials, and zemindars, and taking notes of their statements, I was enabled to obtain statistics showing the different kinds of crops grown, the modes of cultivation, manures used, &c. In order to check and test the results to my enquiries I sent a circular to all Sub-Deputy and Assistant Opium Agents asking them to make similar enquiries during their cold-weather tours, and to submit reports to me by the end of March. I have received reports from the following gentlemen noted in the margin, all of which contain useful information, while the reports submitted by Messrs. Harrison and Christian are especially valuable, inasmuch as they give, what I may be permitted to call, weighed and measured statistics. General estimates which, as His Honour the Lieutenant-Governor has pointed out, are little better than guesses are of no practical use, and even carefully compiled facts about the present systems of agriculture, though interesting enough, are not of much ultimate good unless they lead to economical improvements.

J. Christian, Esq., Opium Sub-Deputy at Hajipur.
C. Harrison, Esq., Opium Sub-Deputy at Chuprah.
D. Savi, Esq., Opium Sub-Deputy at Tehta.
G. Field, Esq., Opium Sub-Deputy at Motihari.
C. E. Mendham, Esq., Opium Sub-Deputy at Monghyr.
A. G. Tytler, Esq., Opium Sub-Deputy at Sawan.

3. The Pichasa state, which covers about 330 acres, lies three miles to the north of Behar. The soil is poor, the people mostly Rajputs, lazy and ignorant, and when I took charge of the estate, they were, owing to two successive bad seasons, wretchedly poor.

The crops sown are divided as usual into three main divisions—the *kharif* the *bhadoi*, and the *rabi*. I have a complete list of all the crops sown and the area under each crop. The area depends mainly on the amount and incidence of the rains, for there is only one well made last year by Govern-

ment on the estate. In former times the village was irrigated by a branch of the Panchana which flows past the village. As much water as the villagers required was diverted by means of a water channel or *pain* into a commodious *ahar* or reservoir, where it was stored till it was required, and then distributed by means of small canals over the whole area. Of late years unfortunately the main stream of the Panchana has taken another course, the old bed has silted up, and unless the rains are abnormally heavy the village now suffers from a deficiency of water. Nor is that all, for during the hot weather the dry sand from the bed of the river is blown by the prevailing west winds over the adjoining fields, and the result is that the soil of the south end of the village is impoverished by the excess of sand which in some cases has rendered the fields incapable of bearing anything but the most stunted description of cold-weather crops. In the year under review the rains were late, and though small plots had been planted as nurseries with rice seedlings, the cultivators had but little hope that these would ever be transplanted, and the bulk of the area which might have borne paddy was planted out with corn (*makai*). Altogether 83 acres were sown with corn and 10 acres with *marua* and *kauni*, the two other *bhadoi* crops grown in this village. Eventually heavy falls of rain improved the aspect of affairs. Heavy floods poured down the Panchana, and a fair amount of water was diverted into the reservoir by means of a temporary dam. The result was that nearly 40 acres were sown down with paddy transplanted from the nurseries. To make room for this crop, some of the Indian-corn and the millet *junri*, which had been sown over about 7 acres, had to be sacrificed; but the villagers care nothing for such catch crops provided they can secure a good paddy harvest. Of the crops sacrificed some was used as green food for milch cattle, of which there is a fair amount in the village, and the plough bullocks, and the rest rotted with excessive wet, and was wasted, except in so far as it served for manure in the fields in which these crops had been sown. As this is no unusual phenomenon, I attempted to teach the villagers the advantage of ensilage as a means of preserving crops that would be otherwise wasted. There was no soil on the estate in which it would have been possible to make a pit silo with any hope of success, but I thought it might be possible to convert an abandoned hut into an overground silo. The walls of such a hut were repaired, and the enclosure so formed was packed with *junri* (or *chota janera* as it is sometimes called), and the whole covered with earth. I gave particular instructions that as the silage sank, more earth should be added, and all cracks filled up, but my instructions were disregarded, as was natural, considering that the villagers could not be expected to believe in such a novel process, and eventually when the silo was opened its contents were found to be barely edibile. It is essential that the cultivators should see good ensilage properly made before they will take the trouble to try experiments for themselves with sufficient care and watchfulness. Of the other crops included here in the *kharif* harvest, the most important is a small pulse called *biringi* grown over ten acres simply as a fodder crop. The remaining three acres were grown with early *rahar*, potatoes, *kurthi*, chillies and brinjalls. The whole area under *kharif* amounted to about 60 acres.

The area under *rabi* or the cold-weather crops was larger than that under *kharif* and *bhadoi* taken together. It amounted to 185 acres, Of which 88 acres mostly poor land was under barley, wheat, and gram grown generally as mixed crops. Indeed only four acres was grown with wheat alone, and less than half an acre with gram alone. The favourite mixture, that of wheat and barley (*gujai*) was sown over 58 acres. Next in importance come *rahar* cotton and castor oil. *Rahar* alone covered 17 acres, *rahar* with cotton alone 23 acres, and with cucumbers (*kakri*) in addition to the cotton 20 acres. Cotton was not sown by itself. Castor oil grown on very sandy soil which will bear nothing else was sown over 16 acres. The remaining crops covering rather more than 20 acres were comparatively unimportant. They consisted of melons (*kharbuza*) six acres. *Khesari* and linseed sown on the better kinds of paddy land which could be irrigated from the well six acres, mustard, peas, and false hemp (*sanai*). The last is grown for rope, but in one case where the crop failed, it had been ploughed in as green manure. This brings me to the consideration of the main purpose of watching their modes of cultivation, which I did at intervals throughout the year, viz., in order

to introduce practical improvements. Here, if anywhere, where the soil was poor and the cultivators lazy and ignorant, it might have been expected that some knowledge of scientific agriculture might have been applied with advantage to the usual native practices, but the more I looked into the matter the more convinced I became that I had very little to teach them which they did not already know. The main want of the village was irrigation. No sooner had a well been supplied them than potatoes were introduced of their own accord in place of a less-paying crop, and every inch of the area that could be irrigated from the solitary well was taken advantage of. Another well or two were required, and I included the cost of their construction in the estimates, but the cultivators themselves wanted no teaching that wells were required, and they could select the proper sites for these wells without any help from me. Similarly, though ignorant of surveying and engineering, they could dam the river so as to divert water into their reservoir; they could clean out the channel and repair the breaches in the walls of their reservoir without any teaching from me, and when I suggested the laying down of pipes and the construction of more distributaries, they were able to estimate the number of pipes required, and to lay out the proper course for the new channels. Nothing again was to be taught them as to the proper crops for the different fields. They were if anything too enterprising in this respect, and year after year tried to grow corn in certain fields which, as a rule, gave no paying results. Where one crop failed, either from the weather or insect pests, they were ready to try another. There was no lack of perseverance and ingenuity, and though they listened to my suggestions with politeness, yet generally I found I was only advocating the course they would have naturally followed, or that there was some objection which I had not properly considered. It was no use telling them the value of manure. Every scrap of possible manure (with one exception) which was not required for fuel was applied to the soil. On one occasion I called their attention to the condition of a bit of waste land when I considered that manure was being wasted, but it was pointed out to me that the fields had only been deserted for a few days while weeding was going on, and that as a rule human *excreta* were as carefully distributed over the cultivated land as I could desire. The sole exception to the preservation of all sources of manure is the waste of bones. For this there are two reasons—caste prejudice, and the insolubility of bones unless specially treated. Bones and the products from bones such as superphosphate and other phosphatic manures are largely used in Europe and America as the best special manure for restoring the phosphoric acid which every crop takes out of the soil. In Behar no measures whatever are taken by cultivators to supply this essential constituent of plant food. The result is that the soil is, I believe, invariably deficient in phosphoric acid, and all crops, unless heavily manured with some general manure which supplies all essentials of plant life, suffer in consequence, not only in quantity but in the quality of the grain. Chemical analysis has proved this in the case of Indian wheat, and it must be equally true of other grains. The constant drain on the available phosphoric acid in the soil which the cultivator refused to check was to some extent remedied by nature. Matter being undistructible the bones of the dead animals that were left uncared for gradually decomposed and the phosphoric acid was in time restored to the soil, but of late years a trade in bones has developed in Behar. Bones are no longer left to rot in the village Galgotha, but are collected by low-caste men and exported to Calcutta. The result is that this source of fertility is now permanently removed from the soil of Behar, and unless this trade is checked, the fertility of all soils must be permanently impaired. To talk of the value of bones as a manure to the ordinary cultivator is practically useless, even though he may have used fish manure for his trees.

The only way to bring home to him the folly of wasting this manure is to shew the improved outturn from crops which have been manured with bones. The quickest means of rendering bones soluble and effective is to dissolve them in acid, but the process is too costly for adoption by the ordinary farmer. Accordingly I proceeded to ferment bones in various places, and these will be applied to crops not only at the demonstration farms under my charge, but in a number of villages under the Court of Wards. It is to be

hoped that the increased outturn, and the ease with which this manure can be prepared may overcome caste prejudices, but of this it would be unwise to speak too confidently. In one case I induced an intelligent zemindar, Moulvie Fazlar Rahman of Dunri, to manure his beet-root with some bones which he had buried some years ago. The result was that he obtained finer roots than he had grown heretofore, but they were literally unsaleable in the local bazar solely because they had been manured with bone. No such prejudice was shown at Arrah against the wheat which I had grown there on land similarly treated, so the experiments will be continued with the field crops, though the effect of bones is usually more apparent when applied as in Europe to root crops.

4. I now come to implements. The crudity of Indian Agricultural tools is well known, and it is might be expected that in this direction some practical improvements could be introduced. At the outset one is met with the difficulty that the modes of cultivation and the animals employed are so unlike what are used in England that it would be ridiculous to introduce any implements now in use at home into an Indian village. One fact alone, viz., that the Indian farmer does most of his work, *e.g.*, reaping, hoeing weeding and the like in a squatting position instead of a standing one debars at once the great majority of English tools and plant. It is essential, therefore, for any one wishing to improve native implements that he should be an inventor. It is obviously extremely difficult for any one without a special training, coupled with an intimate knowledge of native implements, to invent or even suggest any improvements that are likely to be generally accepted. Numerous attempts have been made in this direction, but with the exception of the Beheea Sugar Mill the new implements have not as yet met with general acceptance.

The idea that the quality of implements might be improved without altering their shape and without materially increasing their cost led Government to direct that collections of implements now in use should be sent to the Indo-Colonial Exhibition. The collection from Behar was sent by me, and I await the result with interest; but even if the English manufacturer succeeds in making *kodalis*, *kurpis*, and the like of more durable iron at as cheap a cost, the difficulty of introducing the better class of implement in rural districts where there are no wholesale implement-sellers will have to be met. The village blacksmith and carpenter who now supplies the want of his neighbours by making for them new implements, and also by repairing them from time to time as necessity arises, is usually paid in Behar in grain and not in cash. The rates of remuneration have not only been fixed from time immemorial, but varying as they do with the amount of the harvest they are peculiarly suited to the custom of the country. In a good year when the cultivators can well afford it, the village artisans share in the general prosperity. In a bad season they have to endure their share in the common adversity. Before English-made implements can be successfully introduced this ancient usage must be considerably modified, and the advantage of the new tools must be very marked before the cultivators will consent to abandon the local artisans. So much for the smaller implements, but as regards ploughs attempts to improve their shape, so as to assimilate them as far as possible to the English plough, have frequently been made. The ordinary plough is spoken of as a mere grubber which merely scratches the soil without inverting it. I think the native plough, rude as it is, has been treated too contemptuously. They vary more than casual observers are apt to imagine, especially as regards weight and the depth of furrow they can produce. I have seen ordinary ploughs which will make a furrow at least six inches deep, and the ploughman by going over and over the same piece of ground will thoroughly pulverise and expose to the air the whole upper surface of his field. A plough with a proper mould board would no doubt do the same work quicker and perhaps more effectively, but the difficulty of constructing a mould board which shall do the work effectively and yet be sufficiently light for ordinary bullocks has not, I fear, yet been properly overcome.

The ploughs invented at Barakar and Bhagulpore appeared at first to have accomplished their object. They were tested several times during the cold weather, and at the Barahpur show a grand trial was held at which

fourteen other patent ploughs were tried side by side for three days. The first prize was gained by the Bhagulpore and the second by the Bengal plough. Over a hundred of the latter kind were supplied to zemindars and ryots in wards' estates. These ploughs were light, cheap, and in the case of the Bhagulpore plough capable of repair by the local blacksmith, and I for one strongly advocated their adoption by cultivators; but though they worked effectively in a fairly dry soil which was being prepared for cold-weather crops, they were not nearly so good when tried early in the rains on fairly stiff soils which had to be prepared for paddy and *bhadoi* crops.

Trials were held at Dumraon side by side with the native plough, and in such soils the latter worked much more easily, and made an equally deep furrow. The mould board appears to me to be in fault, for it clogged directly, and instead of throwing off the earth it was carried along with a greatly increased strain on the bullocks. The proper curve for an Indian plough has yet to be discovered, and, in my opinion, an expert in Europe would be more likely to invent the required shape than any one in this country.

Mr. Allen has not received the new improved plough when this was written.

M. F.

Thrashing and winnowing machines have been proposed for the improvement of agriculture, and it has been urged, specially in the case of wheat, that the adulterations of the grain which tend to lower the price of Indian wheat in the home markets may be due to the usual modes of thrashing and cleaning wheat. This subject engaged my attention during the cold weather, and the Commissioner entrusted to me the compilation of his report on the wheat trade of this division. My enquiries proved conclusively that the adulterations complained of were not due to the cultivator's method of cleaning grain, and therefore winnowing machines which must be expensive would be as a rule unsuited to the ordinary cultivator. Similarly thrashing machines which do not cut up the straw so as to render it directly fit for fodder are not to supersede the present usage. I have now touched on a number of failures to improve or even suggest improvements on native systems. I go on to treat of a few points when the study of native practice, combined with what I learnt at Cirencester, have led me to try experiments which will, I trust, lead to some practical improvements in the native systems of agriculture; but though the results have been so far satisfactory, it is impossible to speak with confidence after only one year's experience.

DEMONSTRATION FARMS.

5. The proposal of Mr. Smeaton, Director of Agriculture, North-Western Provinces, led me to institute the farms not entirely to demonstrate the advantages of certain processes, for I hold that no experiments tried at Cawnpore or elsewhere have as *yet* proved conclusively that certain manures or processes are an improvement on native practice, but in order to test such manures and processes which would in all probability prove eventually to be really practical improvements. To any one who is aware of the patience with which experiments have been carried on at Rothamsted, Woburn and elsewhere for a series of years, and the reluctance with which Sir J. Lawes, Dr. Voelker, and other experts have displayed in coming to positive conclusions on scientific facts, it would appear the height of rashness to speak confidently of the advantage of a specific system which has only been tried for a few years at most. Nor would such a man care to incur the responsibility of urging the native cultivator to change usages which have been sanctioned by centuries of practice in favour of other systems which have little but theory to commend them. On the other hand it is futile to ignore the results that have already been established in Europe and to begin our experiments in India *de novo*. For instance, since it has been proved that nitrogenous manures are especially valuable for cereals on almost all descriptions of soil, it is useless to try further experiments to prove this fact over again in India. We know already what manures are best for most crops, but what we do not know yet, and what these Demonstration Farms ought to show, is what manures it will best *pay* the cultivator to apply to the crops he wants to grow. It is no use advising him to try a particular manure, a special treatment of the soil, or any selected seed unless we can at the same time show him that it will pay him to follow our advice. I know

that on any ordinary soil dressing of saltpetre will give, as a rule, a larger outturn of wheat than will result from a similar area that has not been manured, but what the cultivator wants to know is whether the increased outtern will more than cover the cost of buying and applying the saltpetre to his crop. This is the true object of the Demonstration Farm, the crucial question being not whether a special treatment is good for a crop, but will it pay the cultivator. Remembering the natural and perhaps excusable suspicion with which cultivators regard proposals from officials for improving their system of agriculture, I tried to work these farms as far as possible by non-official agency. My proposals were circulated among the chief landowners, and the Maharaja of Dumraon, who has long been known for the interest he takes in agriculture, was the first to agree to a farm being opened on his estates. The services of a qualified assistant from Cawnpore were secured, and some 15 acres of land were set apart for carrying out experiments under my supervision and control. The delay in opening the farm interfered with the success of the first experiments with paddy and *bhadoi* crops, but the *rabi* experiments have given most satisfactory results. The experiments with paddy and *bhadoi* crops may be very briefly described. Nine plots, each a standard bigha of 1,600 square yards in extent, were sown with paddy. Eight of these plots were sown broadcast in the ordinary way, and in the ninth the seed was sown behind the plough. Of the eight plots four were unmanured, one was manured with cow-dung, one with ashes, one deep ploughed, and the last was topdressed with saltpetre. The crop could not be sown till the 17th July, and so the outturn was poor in every case. A slightly increased yield was obtained over the unmanured plots by all those that had been specially treated, and the largest outturn both in grain and straw was afforded by the saltpetre plot, though that had suffered most severely from water-lodging. The *quality* of the paddy from this plot was particularly fine, and the sample sent to the Barahpore Show gained the first prize; beating over a hundred specimens which had been sent from all parts of the division, and also from a few districts in Bengal. Dressing paddy with saltpetre has never, I believe, been tried before, and I hope the experience of future years may establish the advantage of his treatment.

Six plots were planted with the ordinary *bhadoi* crops, maize, *saman*, and *kodo*, selected seed from Cawnpore being sown in three plots, and local seed in the others. All these crops were destroyed by heavy rains as they were put in late, and experiments in *bhadoi* crops will be tried in future on another site. On one of these plots an experiment was tried of growing roots from English seed sown late in January, but the outturn was very small, and I do not intend to try this plan again. On another plot an attempt was made at the suggestion of Dr. King to grow *sorgho*, a cold-weather crop. The crop was sown during the last week of October, and it was cut for fodder early in May and fed to bullocks. The crop did very well, but I see no practical advantage in showing that *sorgho* can be grown as a cold-weather crop. The ordinary ryot will never give up the land which would grow him a grain crop, and whose straw will feed his cattle, for a purely fodder crop like sorgho, unless he can grow it like *janera* in the rains, and still get a larger outturn than he would from one of the usual *bhadoi* fodder crops.

Guinea grass was also grown sucessfully over a small area. This may in time become popular, as it can be grown in odd corners and along water-courses which are unsuited for other crops, but in Cawnpore on the farm where it has succeeded very well the natives would not use it though they have been granted leave to cut it free of charge. Guinea grass has also been grown successfully this year by Mr. Power, the Collector of Arrah, and he finds that it gives an excellent food for horses. Lucerne will also grow well in Behar during the cold weather, but natives will not I fear spare the land for its cultivation.

I now come to the rubbi experiments which must be treated in greater detail, for if the results of similar experiments in future years corroborate the conclusions that are to be drawn from the first year's trials, we shall have demonstrated at least two modes of growing wheat which are distinctly improvements on the ordinary practice of the Indian cultivator, and the consequent benefits that will accrue therefrom to thousands of farmers will alone justify the existence of the Agricultural Department.

The chief crop selected for experiment was wheat. The ultimate object of these experiments is to show what kind of wheat it is best to grow, and how to obtain the largest profit from the cultivation of this crop,

Fourteen 1,600 square yard plots were prepared and cultivated in the manner described below :—

No. of plot.	Description of wheat.	Treatment.	Remarks.
5A	Local ...	Deep ploughed	With this wheat was shown a little gram.
5B	Do. ...	Shallow ditto	
10A	Prize at Dumraon Show ...	Irrigated from well ...	The well was old and the water rich in nitrates.
10B		Ditto ditto canal.	
11A	Mozuffernagar...	Green manured with hemp ...	These two plots were only 800 square yards, but for the sake of comparison the outturn, cost of cultivation, &c., have been doubled. The hemp was ploughed in 15th September.
11B	Ditto ...	Unmanured ...	
12A	Ditto ...	Manured with ashes 1 maund.	
12B	Ditto ...	Ditto ditto 1 ditto and top dressed with saltpetre.	One maund of crude saltpetre mixed with an equal weight of dry earth.
12C	Local ...	Manured with Rs. 2 worth of cowdung.	
12D	Do. ...	Unmanured.	
12E	Buxar ...	Top dressed with saltpetre November 29th.	Ditto ditto.
12F	Do. ...	Unmanured.	
13A	Mozuffernagar...	Ditto.	
13E	Local ...	Ditto.	

The plots were arranged so as to make the comparison as fair as possible, and all were sown from the 16th to the 20th October. Careful accounts were kept of the expenditure on each plot. The outturn in grain and straw per plot and the equivalent yield per acre is given in the following table. It must be remembered that the residues of previous crops invariably affect results, and in the absence of former records it is impossible to say what fields benefitted most from treatment in previous years, but the error due to this cause is comparatively small, as none of these lands had formerly been generously treated—

Number of plot.	Grain per beegah	Straw per beegah.	Grain per acre.		Straw per acre.	
			Mds.	s.	Mds.	s.
5A	439	698	16	7	25	29
5B	374	602	13	31	22	8
10A	382	460	14	3	16	38
10B	243	307	8	38	11	13
11A	736	1,002	27	6	36	38
11B	422	598	15	22	22	2
12A	545	602	20	4	22	8
12B	631	607	23	11	22	15
12C	501	608	18	19	22	17
12D	372	458	13	28	16	35
12E	739	1,702	27	10	62	31
12F	383	469	14	5	17	12
13A	416	348	15	13	12	33
13B	344	491	12	27	18	4

Plots 5A and 5B are intended to show the advantage of deep ploughing. Contemporaneous experiments at Arrah do not corroborate these results, but at Siripur deep cultivation gave in one case 22 and in another 13 per cent. larger yield than the shallow ploughed areas. Theoretically deep ploughing must give a larger outturn provided the subsoils are not inferior to the surface layer, or the greater the surface exposed to the action of the weather, the greater will

be the amount of soluble plant food within reach of the crop rootlets. Besides wheat, these two plots gave respectively 39 and 25 maunds of gram.

Plots 10A and 10B show apparently that well water is far superior to canal water for wheat, but the result of this experiment is rather misleading, for the soil of 10B was inferior and besides the well water was unusually rich in nitrates. Compared with 12D, which was also canal irrigated, the advantage due to well water is reduced to 15 seers of grain per acre.

Plots 11A and 11B were intended to show the advantage of green manuring, and the result is very significant. The false hemp *sanai* was sown in July, which was allowed to grow till it began to flower on the 15th September, when it was rolled and ploughed in. This plot was again ploughed on the 3rd, 5th, and 6th. The clod crusher *chauki* was passed over it four times on the 10th, and the wheat was sown on the 20th. The Arrah experiments fully corroborated these results, the outturn in both cases nearly equalling that of the best crop, viz., that topdressed with saltpetre. Of the remaining plots the following points may be noted :—

There are four unmanured plots, viz., 12D, 12F, 13A, and 13B These four plots were sown respectively with local white, Buxar, Mozuffernagar, and local red wheat. Taking grain above the crops come in the following order—(1) Mozufferpagar, (2) Buxar, (3) white, (4) red; but if we consider the straw only the order is (1) red, (2) Buxar, (3) white, and (4) Mozuffernagar. The average outturn in grain from the unmanured plots may be taken as approximately equal to about 14 maunds to the acre At Arrah the average was about 10½ maunds, but the land here in a good season is more suited for wheat than the lighter soil of the Arrah plots. Taking 14 maunds as the average, and disregarding for the present the difference due to the kind of grain used, we may note that the advantage per acre due to the use of ashes alone comes to 6 maunds to the use of ashes and saltpetre 9 maunds, to cowdung only 4 maunds, and to saltpetre alone over 13 maunds. In fact the outturn here is nearly doubled. I consider the yield from ashes and saltpetre, on 12B, which should have given the best result, as abnormally low. On the other hand the outturn from 12E is simply astounding. Twenty-seven and a quarter maunds of grain which I found equal to 34½ bushels to the acre would be considered a very good crop on good soil in a good year in England, but here in India it is, I believe, unprecedented. The outturn of straw over 60 maunds to the acre, or say 2¼ tons, is also very high, for it more than doubles the weight of grain which is not usual with a good crop. As I saw and examined the grain weighed, there can be no doubt of the accuracy of the figures given above.

I also took the weight of the different kinds of grain per bushel which reached in some cases over 66 maunds. In appearance the Mozuffernagar grain looked best, and I have carefully set apart the grain from the beardless ears in the hope of growing in time a beardless variety of wheat.

The beard or awn seems to interfere with the growth of the grain contorting the ear in a remarkable way. The attempt to grow a beardless variety will, if it succeeds, be of some scientific interest as well as of practical importance.

The following table shows the approximate cost per acre of each special manure, the excess in grain and straw resulting therefrom, and the net profit taking the value of grain at Rs. 2 and of straw at annas 5 per maund :—

Treatment.	Cost			Grain.		Straw.	Net profit		
	Rs.	A.	P.	Mds.	srs.	Mds.	Rs.	A.	P.
Green manuring	8	8	0	12	0	15	19	4	0
Ashes	6	13	0	4	20	.....	2	3	0
Ashes and saltpetre ...	15	0	0	7	20	.....	Nil		
Cowdung	6	3	0	4	20	2	3	5	0
Saltpetre alone	9	6	0	13	0	45	27	14	0

In calculating the cost of the special treatment I have included the increased cost of reaping, thrashing and winnowing the larger yield, so as to show the true net profit.

The cost of applying saltpetre over an acre would only be 7·14, but the increased labour of reaping, &c., raises the charge to 9·6. The actual profit of green manuring has been understated, for no account has been taken of the unexhausted residues of this manure.

This remark applies to all the manures except saltpetre, which leaves practically no residues for future crops.

The great want of Indian agriculture has been manure, and if future experiments will only corroborate these results, I shall have shown that there are two manures within easy reach of every cultivator which can be profitably applied at any rate to the wheat crop, and if to that in all probability to other cereals also and to sugarcane. The Arrah experiments also showed the pre-eminence of saltpetre, but at Siripur, where the crop was not irrigated, the advantage was barely apparent. Neither of these processes are inventions. Green manuring has been practised in parts of Behar, and in a few villages saltpetrous earth has been applied to poppy, but no attempt has been made heretofore in Behar to estimate the actual net profit of these processes when applied to wheat, and it is in this direction that further experiments are urgently required.

This is being done. M. F.

In order to extend the area under these experiments, I have requested you to ask members of the Agricultural-Horticultural Society, who are willing to co-operate with the department, to try in various parts of India the experiment of topdressing with saltpetre, and the experiment is so cheap and easy to conduct that I hope it will be tried in a large number of cases.

I give here the analysis of the soils at Dumraon, Arrah, and Siripur, which were made at my request by professor Kinch at Cirencester, to whom I sent samples that had been prepared in accordance with his instructions.

First soil Dumraon from paddy land.

	Per cent.
Moisture in air-dried sample	6·59
Moisture re-absorbed on exposure to air	5·28

Percentage composition of dry soil.

Organic matters and combined water	5·53
Sand and silicates (including clay) insoluble in hydrocholne acid	72·33
Alumina	10·16
Ferric oxide	7 46
Lime	1·00
Magnesia	1·26
Potash	1 58
Soda	·18
Phosphoric acid	·10
Carbonic acid, sulphuric acid, chlorine, &c., by difference ...	·40
	100·00

The soil is a stiff clay free from gravel or stones.
On mechanical analysis it yielded—

	Per cent.
Coarse sand	10·3
Fine sand	8·0
Clay and impalpable matter...	81·7
	100·0

The sand consisted mainly of quasty and ferruginous sand with some finely divided felspathic matter amongst the fine sand.

The soil contains a moderate amount of lime (equivalent to 1 78 per cent. of carbonate of lime), but only a very small amount of it exists in the soil as carbonate, most of it being silicate. Magnesia is in rather larger quantity than lime. It is very rich in potash derived from the felspathic matrix, but is poor in phosphoric acid and in combined nitrogen.

It gives up very little soluble salts to water; these contain both sulphates and chlorides.

* Containing combined nitrogen equivalent to ammonia ... ... ·06

It consists mainly of true clay, which gives it a high retentive power for water, but it requires liberal manuring with phosphatic and nitrogenous manures such as guano or bones.

It is likely to be benefitted by liming.

Second soil Dumraon from rubbi land.

	Per cent.
Moisture in air-dried sample	5·91
Moisture re-absorbed on exposure to air	5·18

Percentage composition of dry soil.

* Organic matter and combined water	5·37
Sand and silicates (including clay) insoluble in hydrochloric acid	72·92
Alumina	10·40
Ferric oxide	7·27
Lime	·65
Magnesia	1·31
Potash	1·29
Soda	·21
Phosphoric acid	·10
Carbonic acid, sulphuric acid, chlorine, &c., by difference ...	·48
	100·00

This soil was free from stones and gravel. Or mechanical analysis it yielded :—

	Per cent.
Coarse sand	7·8
Fine „	17·2
Clay and impalpable matter	75·0
	100·0

The sand is chiefly quasty with some ferruginous sand, the finest matter contains decomposing felspar.

The soil gave ·98 per cent. of soluble salts to a moderate quantity of water, these salts contained a good deal of chlorides and a moderate amount of sulphates. This soil is very similar in chemical composition to Dumraon No. 1 soil; it contains a little more sand and rather less lime than that however. The lime is equivalent to 1·16 per cent. of carbonate of lime, most of it existing in the soil as silicate; it contains twice as much magnesia as lime, is rich in potash, and poor in phosphoric acid and in combined nitrogen.

It contains a good deal more soluble salts (chlorides, sulphates, &c.) than the No. 1 soil which causes it to settle down when mixed with water more quickly than No. 1, and probably causes differences between them in "working" qualities.

It requires similar manuring to No. 1 with phosphatic and nitrogenous materials, and is likely to be improved by liming :—

Third soil from Arrah.

	Per cent.
Moisture in air-dried sample	1·60
Ditto re-absorbed or exposure to air	1·60

Percentage composition of dry soil.

† Organic matter and combined water	1·74
Sand and silicates (including clay) insoluble in hydrochloric acid	88·55
Alumina	4·30
Ferric oxide	3·27
Lime	·66
Magnesia	·73
Potash	·50
Soda	·01
Phosphoric acid	·09
Carbonic acid, sulphuric acid, chlorine, &c., by difference ...	·15
	100·00

* Containing combined nitrogen equivalent to ammonia ... ... ·06

† Containing combined nitrogen equivalent to ammonia ·03.

The soil was free from stones or gravel. On mechanical analysis it yielded:—

	Per cent.
Coarse sand	28·6
Fine sand	32·0
Clay and impalpable matter...	39 4
	100·0

The sand consisted mainly of quasty with two varieties of mica. The soil yields ·45 per cent. of soluble salts to a moderate amount of water, which salts contain both sulphates and chlorides.

This soil contains a good deal of sand and but a little true clay; its water-absorbing power is but small. It is rather poor in lime (the amount being equivalent to 1·18 per cent. of carbonate of lime), which is mainly present as silicate; it contains a good amount of potash, but is poor in phosphoric acid, and very poor in combined nitrogen.

It requires liberal treatment with nitrogenous manures and phosphates to give good results:—

Fourth soil from Siripur.

	Per cent.
Moisture in air-dried sample	·55
Ditto re-absorbed on exposure to air	·55

Percentage composition of dry soil.

* Organic matter and combined water	2·77
Sand and silicates insoluble in hydrochloric acid	52·84
Alumina	1·94
Ferric oxide	2·80
Carbonate of lime	36·64
Magnesia	1·70
Potash	1·04
Soda	·11
Phosohoric acid	·06
Chlorine sulphuric acid, &c., by difference	·10
	100·00

This soil was free from stones and gravel. On mechanical analysis it yielded:—

	Per cent.
Coarse sand	2·7
Fine sand	46·3
Clay and carbonate of lime	51·0
	100·0

The sand consists mainly of quasty and white mica.

The soil gives up ·65 soluble salts per cent. to a moderate amount of water. These salts contain a very fair amount of chlorine and of sulphuric acid. This is a calcareous soil containing more than one-third its weight of carbonate of lime; it has very little retentive power for water, which is much against its productiveness, if in a dry position. It is rich in potash, but poor phosphoric acid, and poor in combined nitrogen, though containing the most of the four samples of soil now examined. If in a suitable situation, it would be useful for mixing with heavy clay soils. Like the other soils, its principal requirements are phospates and nitrogen.

These analysis fully account for the excellent returns obtained by green manuring, which would supply some phosphoric acid as well as nitrogen, and by dressing with saltpetre, which supplied the nitrogen that is markedly deficient at Dumraon and Arrah.

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* Containing combined nitrogen equivalent to ammonia ·088 per cent.

Professor Kinch's remarks also account for the poor yields obtained at Siripur. The soil is markedly deficient in water-retaining power, and as it was never irrigated, the crop was of course very poor. In the coming year the effect of bones, which have been fermented, will be tried at Dumraon. I also intend trying the effect of liming as he recommends. I mean to try a new manure, from which I anticipate good results, viz., shells. These are collected all over the Division by low caste men (generally Musahars), who eat the snails, and sell the shells for about Rs. 3 a maund to lime manufacturers. The effect of empty shells which are rich in lime, and also contain phosphoric acid and nitrogen should be remarkable, and the yield should be still larger of the shells be used uncleaned. There was still another experiment tried at Dumraon, which promises to be an improvement that will commend itself to the ordinary cultivator. My attention was called at Behea to the Mauritius plan of growing sugarcane in ridges instead of broadcast. A small plot was cultivated in this manner in the Behea garden, and the system which economises water, manure, and seed, and also enables the cultivator to grow cane on the same land year after year, was obviously an improvement on the ordinary process. To demonstrate its advantages, and at the same time to show that saltpetre was good for cane, I made four similar plots at Dumraon. In two the land was ridged and the cane planted in the furrows. In the other two the ordinary practise was followed. One plot of each pair was manured in the usual way, and the other two plots received only saltpetre. All the plots are doing well, but the Mauritius plots, which are more economical, look far the best. Some cultivators who came to see them were much impressed, and declared that there was no cane like it in the district.

A similar experiment is being tried at Dumri by Sayud Fazlar Rahman. The cane will not be ready till December; but if the outturn only equals the promise of May, I shall be more than satisfied.

I have referred incidentally to the experiments at Arrah and Siripur. At the former place I induced three Koiri cultivators on the Government estate to grow four (local) bighas (2½ acres) in accordance with my instructions. I paid for enclosing the area with a cactus hedge, and also for some good seed. All the other expenses of cultivation were paid by the ryots themselves, and I arranged to give them compensation if the outturn from the plots specially treated were below that obtained from the plots cultivated in their own way. Fortunately the special plots gave an enhanced yield, and so the cultivators are only too happy to continue experiments on the same terms. The area was divided into eight equal plots, of which four were unmanured. One was deep ploughed, one was green manured, one received bones dug up from an adjoining pit where they had been buried by butchers, and the last was top dressed with saltpetre. Wheat was sown in all eight plots, and as it was cut, threshed, and weighed in my presence, the results which are given in the following table may be taken as correct:—

Number of plot.	How treated.	Outturn of grain.	Outturn of straw.	Yield per acre.		Weight per bushels.
				Grain.	Straw.	
				Mds. s.	Mds. s.	Nos.
1	Dressed with saltpetre ...	430	730	16 32	28 20	63½
2	Unmanured	203	337	.....	.....	62
3	Manured with bones ...	312	576	12 7	22 20	61
4	Unmanured	306	665	.....	.....	62
5	Ditto	228	551	.....	.....	62
6	Deep ploughed	238	343	9 13	13 17	62
7	Unmanured	345	634	.....	.....	62
8	Green manured	347	700 (?)	13 22	27 13(?)	64½
	Average yield of four unmanured plots ...	270	547	10 22	21 14	.....

The extraordinary variation in the yield of the unmanured plots which were all treated in the same way shows the effect of previous cropping on the results of this year's experiment, and discounts the apparent value of the

obtained results from certain manures. In fact, as I have frequently pointed out, the value of any treatment can only be considered as demonstrated after experiments have been tried for a series of years. Still the results of these experiments are more satisfactory and encouraging than I could have anticipated. This is mainly due to the favourable nature of the season, and the care with which the experiments were conducted. Moreover, as there were four unmanured plots situated in different parts of the experimental area, the average yield of each plot may well be taken for comparison with the results of plots specially treated. On the other hand, the ravages caused by rats diminished the outturn from plots 1 and 8. The cultivators themselves were much impressed by the results, and are anxious that the experiments should be continued. None of the plots suffered much from insect or parasitic pests. Red rust appeared on the leaves, but, except in plot 2, barely affected the grain, and even then the rust was checked according to the cultivators by scattering ashes over the plots. They ascribe the immunity from rust enjoyed by plots 1 and 3, which adjoin plot 2, to the application of manure, and possibly there is some truth in their belief.

The following details are of economic interest. The application of saltpetre to plot 1 cost Re. 1-10, which is equivalent to an expenditure of about Rs. 5 per acre. The outturn of grain and straw from No. 1 exceeded the average from the unmanured plots by 6 maunds 10 seers and 7 maunds 6 seers, respectively. So the net profit to the cultivator was at least Rs. 15 per acre, or Rs. 9 per local bigha. The outturn from the plot No. 8, which was green manured, also gave very satisfactory results, which are absolutely accurate as regards the outturn in grain, but owing to the native method of winnowing the outturn in straw may be slightly inaccurate. The yield from No. 3 is quite up to the amount I expected, as bones show little result the first year. The increase in the weight of grain, which received a better supply of phosphoric acid, and the little effect on straw are noteworthy. The weight per bushel is in all cases remarkably high. Though the grain was not weighed for a fortnight after it had been harvested, and it had been well dried by west winds, still the abnormal weight is remarkable, and tends to show the high value that should be commanded by Indian wheat if it were only sent properly cleaned to market. The result of deep ploughing in No. 4 is disappointing. Probably this plot was one of the worst in the area. The outturn in grain does exceed slightly the yield of the next plot No. 5, which was ploughed shallow, but the yield in straw is the worst of all the plots.

The Siripur experiments were undertaken at the request of the Maharajah of Hutwa, who stated that his manager, Mr. M. Buskin, would superintend the farm. As Siripur is situated in the Sewan sub-division of the Sarun district, 24 miles from the nearest railway station, it was impossible for me to visit the farm often, and the result is that only a few of the experiments which I introduced have been carried out. The soil, as the analysis given above shows, is naturally unfertile, and it had been exhausted by a succession of oat crops grown for seven years without any manure. The area selected close to Mr. Buskin's residence was properly enclosed and divided into 20½ bigha plots. Seven of these plots were sown with wheat, two with roots, and the rest with oats. Unfortunately Mr. Buskin's report contains only the record of four plots, two of which were sown with Buxar and two with Mozuffernagar wheat supplied by me. No record is sent of the plots sown with local wheat, which is inferior in quality, or of the different kinds of oats. The roots I know failed. Of the four wheat plot, two were deep ploughed and two shallow. Half each plot was dressed with saltpetre, but my instructions as to the application of saltpetre before the winter showers were disregarded, and the advantage of saltpetre was, according to Mr. Buskin, hardly perceptible, but he did not weigh the yield of the half plots separately, and so it is impossible to speak decisively on this point.

The yield from the four plots was as under—

	Mds.	s.
Buxar deep ploughed	3	15
„ shallow „	2	30
Mozuffernagar deep ploughed	3	10
„ shallow „	2	35

The seed was sown late, and the outturn, as might be expected, poor. The only conclusion that can be drawn is that Buxar wheat is better than Mozuffernagar, and that deep ploughing is profitable. I have written to Mr. Buskin, pointing out that if the farm is to be continued more experiments must be tried, and directions carried out more carefully. Bones were to have been fermented, and an indigo vat converted into a silo, and stored with green oats cut before flowering, but neither of these experiments have apparently been carried out.

ENSILAGE.

(6.) One of the nostrums that have been put forward for the improvement of Indian agriculture is ensilage. From the commencement I pointed out that even the best made silage must be inferior fodder, and that it was no use storing food in this way that could be otherwise preserved. I also urged that common pit silos, unless made in very stiff clay, must give unsatisfactory results. The report of the Ensilage Commission in England has corroborated the views I expressed, and experiments made at Dumraon have shown that pit silos made in ordinary soils cannot be relied upon to give good fodder. There were four silos made at Dumaron, one at Gaya, one at Pichasa referred to above, one in Patna, one in Buxar, and one at Arrah. I was also present at the opening of an overground Silo at Behea and a pit silo made by ryots at Jagdispur.

Of the silos made at Dumraon, two were made in strongish clay, one in a pit with masonry walls, and the last in a loamy soil. Of these silos I expected the masonry one, which had been loaded with grass, to give the best fodder, but the result was disappointing, for though the ensilage was quite eatable, still more fermentation had set in than I expected, and the fodder had blackened, especially near the edges. The silage from the loam pit was, as I anticipated, inferior. Of the other two silos, one stored with grass was rather poor, but the other which had been packed with chopped *janera* gave very good silage, which was greedily consumed by horses and cattle.

The silo at Gaya, which had been sunk in stiff clay, and filled under my own eyes with *janera* and green paddy, gave the best silage I have ever seen. The contents were bought up at once by the Vice-Chairman of the Municipality for the conservancy bullocks. The silo in Patna was made in a fairly strong soil and gave very fair silage. It had been made by a contractor and filled with grass, and the man gladly took the silage in return for his labour and the grass he had put in. The silo at Buxar was made by Mr. Jenkins, the sub-divisional officer, and he obtained some fair silage, which was all consumed by municipal cattle. The silo at Arrah was built over ground by the Collector, Mr. Power, and filled with grass. It has not yet been opened. The Behea silo, which was made over ground by Mr. Burrows, was filled with a great quantity of grass. It covered too large an area, and the silage has blackened in places, and resembled damp hay. However he considered the result satisfactory, and so did the ryots who packed the silo with uncut *janera*, but I cannot concur in this opinion. Grass which is not cut till October, when the rains are over, had much better been dried in the sun. The only stuff fit for ensilage is, in my opinion, fodder that cannot otherwise be preserved. So I would silo the first cuttings of grass during the rains, or a crop of oats that had come on too fast, and which would lodge before it ripened if left alone. Similarly in Behar there is generally a great deal of *makai* and *janara* which is ruined by excessive rain or floods. If this could be cut and stored in a silo before it had begun to spoil, ensilage would be economical. In some years like the one under review, when the rains cease early, a great deal of paddy might be utilized which is now wasted. The crop has reached the flowering stage, and looks and is splendid, but there the growth is checked owing to a want of water. The ears can never fill, and such crops are now usually grazed down; but if cut as was done in Gya and then stored, ensilage is decidedly beneficial. On the whole *janera*, which is always cut green, because the stalks become too woody even for buffaloes if left to grow, is the best crop in Behar for ensilage. The fodder should be cut into small pieces which will pack much better than if stored uncut, and then the cultivator can have green food for his cattle in May, which will enable him to save his *rubbi* bhoosa for the months of greatest scarcity—November and early December.

LOCAL COMMITTEES.

7. In accordance with your instructions I attempted to form local agricultural committees in each district of the Division, so as to facilitate communications between the public and the Agricultural Department. Committees were formed in Patna, Shahabad, and Durbhanga, and the Collectors of Mozufferpore, Sarun, and Gaya expressed themselves in favour of such committees; but, except temporarily, for the purpose of collecting exhibits for the agricultural show at Barahpur, no other local committees were formed. The Secretaries of Patna and Shahabad Committees, Moulvi Fazal Imam and Mr. Burrows, have both cordially assisted me in every way.

LOCAL SHOWS.

8. The local committee of Shahabad, with the Collector as President, inaugurated the first year of their existence by getting up an agricultural show in connection with the annual fair at Barahpur, in the Buxar subdivision. Mr. Jenkins, the subdivisional officer, consented to be Honorary Secretary, and in accordance with your instructions I co-operated with the committee in making the necessary arrangements. The objects of the exhibition were (1) to collect in a convenient form the best specimens of cattle, sheep, poultry, grain implements and miscellaneous goods; (2) to show at work a number of machines and implements, so that the large concourse of cultivators who attend the fair might be able to judge for themselves of their value; (3) to distribute selected seed and implements to those who required them. To ensure the first object, the Collectors of each district in the Division were asked to form local committees which should collect and forward selected exhibits from their respective districts. These committees were formed and gave the Central Committee valuable assistance. The result was that only selected seed found its way to Barahpur, and the competition for the prizes given by the Committee was confined to really good specimens in each department. Unless this power of selection be exercised, an agricultural show becomes flooded with a mass of worthless articles, the labour of arrangement is multiplied, the work of the judges increased, and the pleasure of visitors who have to search for grain among an intolerable amount of chaff destroyed. The Barahpur show was held in the first week of March. Temporary sheds had been constructed under a grove of trees near the fair. In these were arranged the exhibits of grain and miscellaneous articles, and some of the implements and machinery. The cattle, sheep, poultry and other live-stock were shown in an adjoining enclosure, and alongside of this threshing machines, water-lifts, sugar refiners and other machinery were shown in actual work. Just beyond this space some two acres of land were set apart for the ploughing competition which went on for several hours on each of the three days during which the show was kept open. The Maharajah of Dumraon erected a camp for such of the visitors as could not be accommodated in the different camps laid out by the local authorities.

In spite of the heat and the discomfort of living in tents when strong west winds are blowing, the exhibition which was opened by the President on the afternoon of the 4th March was well attended by visitors from a distance, besides the immense numbers from the fair who streamed through the show every day from sunrise to sunset, scrutinizing the prizes and watching the machinery that was working at intervals all day long. A report of the show will no doubt be sent to you by the Secretary, and as you were present yourself for the greater part of the time that the show was open, I need not describe it in detail. I may say that the objects of the Committee were secured. There were competitors for almost every kind of exhibit for which prizes had been offered, and nearly Rs. 900 were distributed in cash, besides certificates of merit, and ploughs to such of the prize winners as perferred receiving a plough instead of only cash. Selected paddy from the Patna district was distributed among the ryots of Shahabad, and Buxar wheat was sent to the Patna district. The presence of Mr. Muhammad Hossein, Assistant to the Director of Agriculture, North-Western Provinces, who brought down with him machinery, models, and samples of seed, added materially to the success

of the show, and the favourable terms in which he spoke of it was decidedly encouraging.

I have now described generally some of the work that has been done towards improving the agricultural practice of the Division. The description was not intended to be exhaustive, as fortnightly diaries have kept you informed of the work as it progressed.

TOURS.

9. I refrain from giving a journalistic account of my tours. Properly speaking I have made no systematic tours, but have gone whenever and wherever my work called me. There have been repeated visits to Pichasa and Arrah to look after the estates under my charge. I have had to visit at intervals Dumraon and Siripur and other places where land-owners have asked my assistance. I have visited several Government and wards estates in company with the Collector of Patna and the Manager of the Court of Wards who have been good enough to consult me as to the best measures for improving these estates. I have also inspected Gora Katora, the proposed site for a fuel and fodder reserve, and I have visited those municipalities who asked my help in checking the waste of sewage that was going on. Most of my time has been spent in the two districts of Patna and Shahabad, but I also went to Gaya, Chupra, Motihari and Mozufferpore so to consult the Collectors as to the best means of extending my work to their districts; but as I received most sympathy and encouragement from Mr. Quin and Mr. Power I thought it best to confine my efforts mainly to their districts. Of the sub-divisional officers, Mr. Jenkins at Buxar has worked most cordially with me, and the institution and success of the Dumraon farm is largely due to his influence. Mr. Carnduff at Hajipore and Mr. Ahmad at Behar have both helped me to check the waste of manure in the municipalities under their charge, and both of these officers and also Mr. Holmwood at Barh and Mr. Macpherson at Sasseram assisted in procuring exhibits for the Barapore show and in other ways which I am glad to acknowledge.

OFFICE ESTABLISHMENT, &c.

My office consisted of one clerk on Rs. 30 a month and two peons each on Rs. 6, and a charge of Rs. 8 for contingencies made the total charge of the office Rs. 50 a month. The expenditure during the year on agricultural experiments and improvements amounted to Rs. 1,824-13-8 exclusive of the money spent on ward and Government estates at my suggestion.

I.—ORGANIZATION AND MAINTENANCE OF VILLAGE RECORDS.

I was not requested to do any work under this head.

II.—ANALYSIS OF DISTRICTS WITH REFERENCE TO SECURITY FROM FAMINE.

This subject has received my attention and I submitted a report on the subject of fuel and fodder reserves. The construction of the Tirhoot and Gaya State Railways has rendered a recurrence of the *scarcity* of 1874 practically impossible. Every part of the division which is at all thickly populated is in easy communication with the outer world, and though bad seasons may affect harvests, scarcity of food is no longer possible.* In fact each of the seven districts may be said to be absolutely secure from famine. Though cattle fodder is scarce except in the thinly populated tracts along the north and south of the division, I do not advocate the creation of fodder reserves. There are no large *usar* tracts as there are in the North-Western Provinces which require reclaiming, and in the valley of the Ganges almost all the land is arable. It would not only be expensive to acquire land for making fodder reserves, but the proceeding would, I venture to think, do more harm than good.

* Railways may bring food in a year of failure of crops, but they will not enable the people to buy it.

M. F.

Cattle, except plough and cart bullocks, naturally decrease, as the pressure of the population on the culturable area increases. It is a mistake to try and keep these half starved cows alive in a country where the fodder grown is barely enough for the bullocks. All along the north of Chumparun or in the

But how are the people to get on without milk?

M. F.

south of Gaya, or on the Shahabad plateau where population is scarce and fodder plentiful, cattle can properly thrive, but in Patna, Sarun and those parts of the other districts which are crowded, the cows which trespass by night on the farmers fields had better be driven off to new pastures rather than encouraged to live on as they do now. The better class of cultivators now buy their bullocks at fairs, such as those held at Sonpur and Barahpur, and they get a much better article for their money than if they attempted to breed for themselves at home.

III.—SYSTEM OF COLLECTION OF REVENUE AND RENTAL IN PRECARIOUS TRACTS.

True in one sense, but not in another, *vide* Chapter III of annual report.

M. F

There are no precarious tracts in the Division.

IV.—MEASURES OF PROTECTION INCLUDING ABORIGULTURE.

I have little to say under this head, except that I do not believe that the number of trees in the Division are diminishing. Besides the avenues which are planted by the Road Cess, numbers of trees are planted by private persons, and the tendency of cultivators to plant trees will increase with greater fixity of tenure.

Differs from information given me by planters in Tirhoot.

M. F.

V.—AGRICULTURAL EXPERIMENTS INCLUDING FARMS.

These have already been described.

VI.—INTRODUCTION OF AGRICULTURAL IMPROVEMENTS, SUCH AS CATTLE-BREEDING AND VETERINARY COLLEGE.

The subject of cattle-breeding is one of great importance. The inferiority of cattle-bred in Behar is well known, and under existing circumstances with grazing grounds and fodder becoming scarcer, the breed is likely to deteriorate still further. The possibility of introducing an improved stock, such as is found in the North-Western Provinces, is open to some question, but I am of opinion that the project is feasible if systematically carried out, for theoretically the soil and climate of Behar are not unsuitable for breeding good stock. I submitted a proposal (No. 72 of 13th February 1886) for improving farm stock, but as yet no orders have been passed on my plan. In brief, it was to purchase a bull and twenty heifers of a good breed, say from Hissar, and make them over to a selected manager of a factory on certain terms which he would be willing to accept. The result would be a superior breed of cattle which would be raised, if my proposals were approved of, without any cost to Government, except the initial charge for the purchase of the bull and heifers, which would not exceed Rs. 1,000. A few of these studs placed in suitable factories would soon make a marked change in the breed of cattle raised in Behar, and subsequently Government might help to check the continued production of inferior cattle by imposing a tax on all stallion bulls and buffaloes. The introduction of bulls alone though productive of some good can have no permanent effect on the breed of the local cattle. Even if carefully selected so as not to be too large, the cows once covered and their progeny are lost sight of, and each succeeding generation the improved stock tends to revert to the former inferior type. Something, however, may be done in this direction on large Government estates. This year two bulls were bought at my request from Hissar. Mr. Burrows of Behea sent a cowherd especially to select them so as to suit the local cattle. They have been made over to Government estates—one to Buxar, and the other to Nasriganj. Mr Jenkins and Mr. Mcpherson, the two sub-divisional officers in charge of these estates, are both much interested in agriculture, and if the bulls are as good as they look, there should be an improvement in the stock on these estates. It has also been proposed to open a breeding establishment in connection with the veterinary college, which it is suggested should be made at Bhagulpore. At your request I visited Bhagulpore and viewed the old parade ground and the sepoys lines, which might be utilized as cattle sheds. There is ample grazing ground there, and soil seems suitable but the cost of making and maintaining a

Government breeding establishment would far exceed the plan I suggested of utilizing the gratuitous services of indigo-planters in Chumparun and Tirhoot, who, being themselves much interested in improving the breed of cattle in their neighbourhood, would superintend the work efficiently and *con-amore*. The introduction of other agricultural improvements has been referred to above.

AGRICULTURAL AND TRADE STATISTICS.

I propose under this head to give some of the facts concerning the Pichasa estate, which have been arranged in the order given in Appendix A of your No. 15 of the 26th May 1885.

I. AGRICULTURE.

The estate covers an area of 529 bighas, which is equal to about 330 acres, and of this not more than 250 is ever cultivated. There are a few mango and mahua trees and a considerable number of palm trees, most of which have been recently planted and as yet give no toddy. The village consists of eighty households, and the land is cultivated by 55 tenants, of whom all but 8 live in the village. Of the tenants, 18 are Rajputs, 12 are Koiris, 7 are Gwalas, and 7 are Musalmans, For the rest there are 4 Brahmans, 2 Chamars, 1 Barhi, 1 Sahu, and 1 Dusadh. The landless labourers, chiefly Chamars work as serfs (*kamias*) for the Rajputs whose fields are as a rule much worse cultivated than those of the Koiris who here, as elsewhere in Behar, are the best farmers in the place. There are no local bunniahs, but two Sahus from the neighbouring town of Behar supply the capital for carrying on the cultivation of the land. On money borrowed there is a first charge of 24 per cent. per annum; but though borrowed in cash, the loan is invariably repaid in grain, the bunniah sending his bullocks to the threshing flo r and taking over the value of the loan at the current price of grain. For instance, if a man borrowed Rs. 100 in May and bought seed, &c., when paddy was selling at 23 seers for the rupee, he would have to repay in December Rs. 116 worth of paddy, which might then be selling at 35 seers for the rupee. Owing to bad seasons, and in spite of large remissions, the villagers are considerably in debt to these bunniahs.

Soil.

The soil varies from loam to nearly pure sand. None of it is very good, and some is almost perfectly sterile. The rent paid varies from Rs. 2 to Rs. 5. At the request of the Collector I have prepared a revised rent-roll reducing the rents in the south of the village, where the soil had been permanently injured by blown sand.

The holdings.

Vary in size from 40 bighas (25 acres) the largest to 2 kottahs the smallest. Where holdings are less than 8 bighas (5 acres) some members of the family have to eke out the means of subsistence by working as labourers.

Crops.

I have given above a list of the crops grown in the village last year, and I have notes of their modes of cultivation, but to reproduce them here would extend this report beyond all reasonable bounds. The chief practical improvement required is money spent on irrigation. I applied for sanction to construct two more wells, and something was done last year towards repairing the reservoir and water-channels for preserving and distributing the water supplied so abundantly by the rains. This important work should be completed during the present year.

Manure.

The articles used as manuure are dung, ashes, sweeping, saliferous earth and all kinds of refuse. Every possible source of manure except bones is utilised. Last year the rubbish after the well had been constructed was carefully collected and put on the land as manure. All classes of soil and crops require manure, but it does not follow that they can get it. None of the villagers can buy manure even if they had the money, for their is none to be sold. This was proved some years ago, when the Opium Department gave advances for the purchase of manure to their ryots.

Does not apply to bone-dust and of oil-cake which can be bought.

M. F.

The ryots gladly took the advance, and it was recovered in due course, but the fields got no more manure than they received before. The more valuable crops, such as potatoes, get most manure, but it is also given to wheat, paddy, corn, and most other crops whenever the cultivator has enough to spare. Certain crops, such as rahar, cotton, and castor-oil never get manure, nor do the fodder crops, *bringi* and *junri* nor the cucurbitous vegetables ; but of course all high-growing crops get manured by the villagers while they are growing, so the land does not rapidly deteriorate.

Stock

The live-stock consists of cattle, buffaloes, sheep, and goats. Bullocks, of which there are about 75 vary in price from Rs. 15 to Rs. 50 a pair. Buffaloes, which are only used for ploughing during the rains, as they cannot work in dry heat, cost only from Rs. 10 to Rs. 20. There are about 40 cows and 30 milch buffaloes, whose price depends on the amount of milk they give.

The usual rate is about Rs. 6 a seer, and as 3½ seers is the utmost any of the Pichasa cows ever give, their price never exceed Rs. 21 or Rs. 22. Buffalo-cows, which give up to 5 seers, sell up to Rs. 32 or Rs. 33. The stock generally is miserably poor and underfed. Oil-cake is never given, and the usual food is straw and water to which those who have mahua trees add the fruit when it is in season. During the rains there is of course plenty of grass ; and *junri* and *bringi* last them up to the end of October. By this time the straw from the *rubbi* is pretty well exhausted, and the cattle subsist mainly on corn stalks and leaves of trees till the paddy harvest supplies them with rice straw which keeps them going till the *rubbi* has been harvested. The fodder obtained would be ample for the plough cattle, but the cows are always half starved, and in a bad season die off from want of food.

DEAD STOCK.

I have a complete list of the tools used, but no suggestions to offer as yet as to their improvement.

IRRIGATION, &c.

On the remaining topics I have nothing to add beyond what has been said in previous paragraphs. In addition to the statistics given above, I have been furnished with some crop statistics by the Collector of Patna, and reports from Sub-Deputy Opium Agents, but I do not think it advisable to reproduce them here.

MISCELLANEOUS.

Before concluding I may mention that, in addition to the work described above, I have had a great deal of correspondence with individuals and municipalities. The work of managing the estates has been omitted, nor need I more than refer to the work I have had to do as Secretary to the Divisional Committee of the Indo-Colonial Exhibition. For the last few months I have been employed on ordinary Joint-Magistrate's work, and on this account my report has been delayed.

At last, owing to the kindness of the Collector, I have been enabled to spare a few hours every day for the last fortnight, and it is in these odd hours that the report has had to be written. I fear that on this account much of what I had to say has been badly expressed or omitted, and I trust that allowance will be made for all shortcomings. I wish to add that for the future I can keep on supervising the farms at Dumraon and Arrah and also look after the estates under my charge in addition to my regular duties as Joint. As a Municipal Commissioner of Patna, I hope I may do useful work in reforming the conservancy arrangements which are at present rather neglected, but it will be quite impossible for me to go on collecting agricultural statistics or to undertake new agricultural work. Possibly in the cold weather when more officers are available, it may be possible to relieve me of ordinary Joint's work, but till then I will carry on my dual offices as well as I can.

APPENDIX II.

No. 192, dated Burdwan, the 5th June 1886.

From—A. C. SEN, ESQ., Assistant to the Director of the Agricultural Department,
To—The Director of the Agricultural Department.

I HAVE the honour to submit the following report on the agricultural experiments and enquiries made in the Burdwan Division, in accordance with the Government Resolution, dated the 2nd May 1885, and your letter to me No. 16, dated the 26th May 1885.

The report is divided into three parts: the first part contains the results of my study of the existing system of agriculture in the division; the second part gives an account of the experiments that were made in fields belonging to ryots and talukdars. It is only incidentally that reference has been made to the experiments carried on in the Raj farm at Burdwan. These will be treated in a separate report, and submitted to you in due course. In the third part I have ventured to make a few suggestions on agricultural improvements which appear to be practicable and on the best method of conducting agricultural experiments.

PART I.

For the better understanding of this part of the report, and to avoid repetition, a few general facts bearing on the agriculture of the division are given here by way of introduction.

INTRODUCTION.

1.—AREA AND POPULATION.

The total area comprised in the Burdwan Division is 13,855 square miles, and the total population 7,393,954 souls, distributed thus:—

NAME OF THE DISTRICTS.	Area in square miles.	Populations.
1. Burdwan	2,697	1,391,823
2. Hooghly	1,223	1,012,768
3. Howrah	476	635,381
4. Midnapore	5,082	2,517,802
5. Bankura	2,621	1,041,752
6. Beerbhoom	1 756	794,428

The density of population is very variable in different parts of the division. The eastern part is most thickly populated, some of places containing the highest number of souls to the square mile known in any part of the world, while population is comparatively sparse in the west. The ratio of the rural to the total population, on the other hand, is least in the east and greatest in the west.

2.—SOIL.

The Burdwan Division is separated from the Gangetic delta by an important branch of the Ganges, and probably at no very ancient date the main stream of the Ganges itself used to pass by the eastern extremity of it. But the soil of most parts of the division differs much from that of the Gangetic delta, both chemically and physically, as might be expected from the difference in their geological origin. The soils of the whole of the western and a very considerable portion of the eastern parts of the division are formed from the debris of the numerous hills of Manbhoom, Singbhoom, and the Sonthal Pergunnahs, and that of Raniganj and Burrakar. In the west, in many places, the soils are formed simply of the subjacent rock more or less altered by the action of rain water, atmosphere, and other disintegrating agencies. The soils of the greater portion of the eastern part consist of materials transported mostly by mountain streams, some large and others small, all having their origin in the hills mentioned above, and flowing eastward and pouring their waters into the Hooghly. Soils showing very evident marks of glacial origin are also to be met with in some places.

The soil is partly a laterite clay, more or less altered, and partly a red-coloured, coarse-grained sand, characteristic of the eastern part of the Vindhya

formation, large surfaces composed of which are to be found in the beds of the Darakeswar, Damodar, Ajay, Maurakshi, and the Sone rivers. In the Hooghly district this peculiar soil is met with as far to the east as the Mugra station (East Indian Railway). To the east of that station we come first to the old bed of the Saraswati, once the great commercial highway of Western Bengal, and then to the banks of the Hooghly. It is only when we come to the police-station of Shabhar in the Dacca district, that we again meet with the same peculiar laterite clay and red sand. To the east of the Madhupur jungle these soils are lost sight of in the beds of the Brahmaputra and the Meghna, and do not reappear till the Magnamati hills in Tipperah are reached.

Characteristic crops.

Paddy and sugarcane are the two characteristic crops of the division. These crops may be grown both in the laterite clay and the red sand, though a soil formed of a mixture of the two would be considered best for sugarcane. The clay is very difficult to work, turning into a mass of most tenacious mud in the rainy season, and is as hard as stone in the summer. On account of this difficulty in many places, especially in the west, nothing but paddy is grown, to which crop this clay is well-suited. After the rains have set in and the clay has been softened, it is worked into mud, in which the rice seedlings are planted by the ryots squatting on the ground. The crops grown, the agricultural practices of the cultivators, the implements of tillage, and the working bullocks or buffaloes are all well adapted to the peculiar nature of the soil and climate, and it is difficult to see how any one of them can be altered with facility to a very great extent. Sugarcane also grows well on this clay soil. The red clay of the Raniganj formation, containing the hydrated sesquioxide of iron, commonly known as ironstone, is rich in phosphorous, and phosphorous, agricultural chemistry tells us, is the predominant element in sugarcane. Sugarcane, however, requires irrigation at a time (April) when water is very scarce, and low-lying places are unsuited to this crop on account of water stagnating on such lands during the rainy season. It is therefore only within limited areas that this important crop can be successfully grown.

A practical classification of the soil.

For the proper understanding of the system of agriculture that obtains in this division, and for the matter of that in the whole of Bengal, the most practical classification of soils is that under the three following heads of (1) high land, (2) low land, and (3) the dearah or river land. Almost the whole of Bengal consists of a number of more or less elevated tracts separated by low-lying grounds. From the nature of their formation in the deltas, the elevated tracts lie along the river banks sloping towards the interior. Generally speaking, these elevated tracts are either sandy or sandy loam, and the low grounds are more or less clay. As might be expected, the high grounds have been converted into human habitations and form village sites. The land set apart for agricultural purposes is that lying around villages. This latter is naturally divided into two portions: 1st.—The higher ground just encircling the village sites, which is more or less sandy, and is either above the ordinary inundation level, or dries up in time to prepare it for the winter crops. During the rains the washings of the villages pass through this part which, as few villagers have fixed privies in their houses, is their usual retiring place. This is the land that fetches the highest rents. It grows a variety of crops. During the rains it is sown with aus paddy or jute, or if above the inundation level, it may be planted with sugarcane. Vegetables may also be grown on it. This is also the land which is most capable of improvement. It will pay to manure it heavily and to plant it with potatoes, sugarcane, onions, plantain, and other important crops. Deeply ploughed there will be ample time to have the newly-raised soil well exposed to sun and air, but unfortunately it forms a very small portion of the area under cultivation in Lower Bengal.

1st.—Aus land.

2nd.—Aman paddy land.

2nd.—The main portion of cultivated area in Bengal proper consists of the lowlying grounds separating the village sites from one another or the marshy lands at some distance from the river banks. This land is mostly clayey, is submerged under water during the rains, and remains dry only for a short time. The only crop this land grows is paddy, and in most rare cases, when not far from the homesteads,

a little summer *til* (sesamun) is sometimes grown. This fact should receive the most careful attention of everybody entertaining any idea of improving the agriculture of Lower Bengal. It is difficult to see how improved ploughs, new staples, concentrated and soluble manures, can find any very important place in the husbandry of the lowlands of this part of the country, forming at least 80 per cent. of the cultivated area, important though these things may be, and are, in uplands and in other parts of the country.

Dearah lands.

The dêarah lands have been formed by the deposition of river silt on the beds and sides of rivers. These are the lands most sought after by the ryots. They are renovated every year during the rains by a deposition of silt, and require no manures. In Bengal they are the most suitable for growing the rabbi crops, the pulses, wheat, barley, and the oilseeds, and the various country vegetables belonging to the order of cucurbitaceæ. These also grow the largest amount of indigo, and if any fodder and fuel reserves are to be made in Bengal, these are the lands to which our attention should be directed. The cultivation of the dearah lands is the simplest in existence. An experienced and well-educated indigo-planter in the Burdwan Division, when asked to give an account of the mode of cultivation of indigo, replied "indigo is not cultivated, but grows wild." This remark is more or less applicable to all the crops grown on such lands. The tillage operations are of a very simple description: one or two ploughings are all that is given and needed. Sometimes the seeds are sown broadcast on the soft mud left by the receding of the inundation water without any previous preparation whatever. In case of green vegetables the operations are mostly done by the spade. The seeds are deposited in holes made in the unploughed ground, and a hoeing is the only operation done afterwards.

3.—RAINFALL.

The weekly rainfall and the number of wet days in the town of Burdwan during the last ten years are shown in Appendix I. For the successful cultivation, the most important point is the distribution of rainfall, and in a country like Bengal the total amount is a secondary consideration. The distribution suitable for paddy—by far the most important crop of Bengal—may be gathered from the following rural doggerels:—

1.	Yadi barshe āghane, Rājā nāmen māgane.	If it rains in Agrahayan, kings have to beg.
2.	Yadi barshe poushe, tākā hay tushe.	If it rains in Pous, rice brings money.
3.	Yadi barshe magher sesh, dhanya rājār punya des.	If it rains at the end of Magh, blessed is the king's virtuous land.
4.	Yadi barsho fāgune, chinā kāon dwigune.	If it rains in Falgun, the yield of china and kangu is doubled.
5.	Chaitre māthamathar.	Slight rains in Chaitra.
6.	Baisākhe jhar pāthar.	Rains and storms in Baisakh are good.
7.	Jaistye re nā uthe.	In Jaistya the ploughshare should never be off the ground.
8.	Ashāre barshā ba the.	Ashar should be a month of endless rain.
9.	Karkata chharkata.	Much rain is required in Sravan.
	Sinha sukānā.	Bhadra should be a dry month.
	Kanyā kāne kān.	There should be much rain in Aswin.
	Binābāy tulā barshe.	If there be rain without wind in Kartik.
	Kothā rakhbo dhān.	Where shall I keep the paddy?

Reading the table of rainfall in the light of these verses, we find that last year the rains commenced late, delaying the raising of seedlings as well as their transplantation, and the late planted paddy was greatly damaged by an excessive rainfall when rains were least required. The year before last the rainfall was deficient both at the time of planting and when the paddy was in ear. In 1883 the paddy was planted in time, but suffered from want of water when the grains were being formed, though the total rainfall was over the average.

It is to be remarked, on the distribution of rainfall as given in the doggerel verses quoted above, that these verses were composed at a time when some of the crops now under cultivation in Bengal had not been introduced, and as regards these crops they require re-casting. It has been mentioned for example, that rains at the end of Magh is a very fortunate thing; but everybody now knows that such a thing would be a sure calamity to potatoe growers.

In the course of my travels through the Burdwan Division I was very much struck with the difference in the rainfall of places not far from one another. Local circumstances, such as proximity to large surfaces of water, hills, forests, &c., have a far greater influence in determining the total rainfall as well as its distribution throughout the year than are generally supposed. Owing to this fact the returns published by the Meteorological Department of India do not render the practical agriculturists the help they might have otherwise done. Our meteorological stations are far too few in number, and not always properly chosen. Generally speaking, there is in a district one station in the sudder town and one in each of the head-quarters of the subdivisions, and unless these places are centrally situated, which is far from being the general case, the rainfalls registered do not represent large areas. Out of the four meteorological stations in the Burdwan district, two represent the rainfalls on the banks of the Hooghly, like those at Chinsurah, Serampur, Howrah, Alipore, and Calcutta. There is not a single station to represent the rainfall over that large tract of the district which lies to the north of the East Indian Railway line.

To render the returns of the Meteorological Department really serviceable to the practical agriculturists, in most parts of Bengal the number of stations should be very greatly multiplied.

4.—IRRIGATION.

The great want of the Burdwan Division, especially of the western and central parts of it, is a proper supply of water for irrigation purposes. The rainfall being often deficient in total amount or irregular in distribution, artificial irrigation is necessary for almost all the important crops excepting the pulses and barley. The cultivation of sugarcane, potatoes, onions, and other important crops can only be undertaken in places where water for irrigation is available. The soil of the division, generally speaking, is fertile, and for the successful growing of any crop the only thing wanted is a sufficient and regular supply of water.

The importance of the subject was fully understood in very ancient times.

Tanks.

In no other part of Bengal are so many tanks to be found, some of them the finest to be seen anywhere, and most of them well situated for irrigation purposes. Without perhaps a single exception, all these tanks have been long neglected. They have been overgrown with weeds and filled up with silt. Unlike tanks in many of the other districts in Bengal, these were intended for collecting the drainage water of the country and storing it up for use in time of deficient rainfall. Hence the silting process has gone on very rapidly.

Canals.

There are some canals lately opened in the division, some of which are not irrigation canals, and even if all of them were utilised for that purpose, they could not be expected to supply water to any very large area.

Wells.

Wells are not numerous in this division, and the cultivators have something like a dread of irrigating lands with water raised from wells. Exceptional cases of the absence of this feeling are to be met with in some parts of the Bankura district.

Irrigation in hill tracts.

In the hill tracts of the west the principle of storing up rain water, which nature raises from the sea to heights to which no human power could have elevated it, is well understood, and the whole system of cultivation there may be said to be dependent on this principle. The terrace cultivation wrongly supposed by many to be peculiar to China is the outcome of attempts to store up rainwater. The hill-sides have been converted into a number of paddy fields of the smallest size conceivable looking like so many steps of an amphitheatre. These fields

have all of them *bunds* or embankments made along the whole length of their lower edges. The rain water in its downward course is arrested by these *bunds*, and instead of being allowed to rush down the hill side in a torrent, is made to water the fields one after another, each retaining its just share and no more. In places where the land is more precipitous and the water has to pass through a narrow channel, (locally called a *kanali*,) a *bund* is thrown accross the valley, converting the portion above it into a very irregularly shaped tank or lake. This *bund* is generally made at where the bed of the channel suddenly becomes somewhat less precipitous, the reason for this obviously being that the cost of making the *bund* is thus reduced, and the *bund* is given a better chance of withstanding the force of the current. In this part of the division what is wanted in order to improve the means of irrigation is to increase the number of tanks and to throw as many *bunds* as possible across every hill stream.

Water obtained from dry beds.

The cultivators along the banks of one or two small streams in the west of the division with sandy beds have discovered a very ingenious means of irrigating their winter crops and sugarcane fields. When water is needed for irrigation purposes at the season when the beds are apparently quite dry, all that is necessary is to make holes in the coarse red sands of which these river beds are made. In a short time a good supply of pure sweet water is thus obtained. I have seen about 400 cubic feet of water collected in this way in the course of one hour.

Who is to repair tanks.

The clearing of the numerous tanks already in existence and the digging of new ones in suitable places is the most important question in connection with the agriculture of this division, but the peculiar system of land tenure that obtains, here has rendered an easy solution of it all but impossible. It is known to all students of Indian laws that the peculiar land tenure known as the patni had its origin in the zemindari of the Maharajah of Burdwan. In the course of time there have arisen different grades of under-tenures known as sub-patnies, darpatnies, sepatnies, &c., each widening the gulf between the head landlord and the tillers of the soil. The zemindars, and even the higher grade patni-holders, have ceased to have any direct interest in the produce of the land, unless and until danger should arise of its being reduced to such an extent as to make the realisation of rents payable to these landlords of the higher degrees difficult, and till then it would be idle to expect these men to spend a pice on land improvement. On the other hand, the cultivators themselves and tenure-holders of the lowest grades, whose interest it is to see that these tanks are kept in repairs, are too poor to do anything unaided. The time, however, cannot be very far distant when the zemindars and the superior tenure-holders will be forced to admit that they can hardly afford to be any longer indifferent to the question of the water-supply of the country, and that it would not be wasting money to spend a few thousand rupees in repairing tanks that were dug at an immense expense by their predecessors. Now that the largest estate in this division, namely, the Burdwan raj, has come under the management of the Court of Wards, it is to be hoped that something in this respect may be done.

Water-lifts.

The implements used in irrigation, like everything else of the Indian system of agriculture, are very simple, but fairly efficient and most inexpensive.

These implements are—

(1) The simni.
(2) The lever arrangement.
(3) The donga
(4) The teri.

(1) *The simni*—Is a triangular-shaped bamboo basket, thickly woven, with four pieces of rope attached to it. Two men, each holding two ropes and standing on either side of the mouth of the channel through which the water is carried to the fields, lower and raise the basket with peculiar dexterity. Water can in this way be raised a short distance only—not more than 6 feet. If water is required at a greater height, instead of raising it at once to the level of the field, this is done in two or more different stages, each requiring as many sets of men. This considerably increases the cost of irrigation. When the height is great, this mode of irrigating land is therefore seldom resorted to.

Two men working about eight hours a day can raise sufficient water for irrigating one bigha of sugarcane.

Cost of irrigation, per bigha	8 annas.
Price of a simui	2 to 4 annas.

(2) *Lever arrangement.*—This arrangement is resorted to in raising water from wells, and is not much in use in the Burdwan Division. It has, however, much to recommend it to the ryots of Central Burdwan. As already stated, canal water is not available, irrigation of large areas while the peculiar land tenure of the division has made the digging of new tanks, or even the clearing of those already in existence, extremely difficult. The ryots can expect very little help either from the Government or the landed gentry, and have therefore to rely chiefly on their own resources. Any ryot with ordinary means can afford to sink a well for himself, and now that the Tenancy Act has assured them the full benefit of any improvements that may be effected by them, they ought to be the more willing to make wells for themselves. The water-lifting apparatus also is not a costly one, and water is to be met with at a moderate depth. The lever arrangement consists of a long pole made either of bamboo or partly of wood and partly of bamboo, having a wood pin passing through it close to its thicker end; the pin rests on the forked branches of a tree or on two uprights fixed at a short distance from the wells: from the longer end of the pole is hung a bucket, called a *kudi*, by means of a thick rope made of straw, and the other end is counterpoised by a lump of earth or a stone. Water can be raised by this arrangement from a depth of 10 to 15 feet. Irrigation with this water-lift is an exceedingly laborious operation, and is somewhat expensive. One man working for eight hours can scarcely raise sufficient water to irrigate one-third of a bigha.

	Rs.	A.
Price of the apparatus, including an iron bucket	3	8
Cost of irrigation, per bigha	1	0

(3) *Donga.*—This may be described as a double lever arrangement. Instead of a bucket hanging from the longer end of the pole, the pointed end of a canoe-shaped wooden vessel, called a *donga*, is attached to it by a rope. The other end of the *donga* rests on the mouth of the channel by which the water is led to the field. Water can in this way be raised only a short distance, and the arrangement is resorted to in irrigating from tanks or *jhils*. One man can with a *donga* irrigate one bigha a day.

Price of a *donga*	Rs. 3 to Rs. 7
Cost of irrigation, per bigha	5 annas

(4) *The teri.*—This is very much like the lever arrangement, but the structure must be of a more substantial character. Instead of a bucket a large earthen pot is suspended from the longer end of the pole, and to the other end is fixed a rope instead of a counterpoise. Three men are required to work it: one man lets down the empty pot into the water of the well or river as the case may be, and two men raise the pot filled with water by pulling down the rope attached to the other end of the lever. This arrangement is used when the water is to be raised to a considerable height.

	Rs.
Price of the apparatus	4 to 6

Two sets of men, each set consisting of three persons, can irrigate one and-a-half bighas per day.

Cost of irrigation	Re. 1 to Re. 1-4 per bigha.

5.—FLOODS.

Floods are regarded as among the most dreadful of agricultural calamities, and unfortunately in some parts of the division are frequent visitors.

It has already been stated that the Burdwan Division differs from the Gangetic delta not only in the chemical composition of its soils, but in its physical aspects as well. The Gangetic delta is devoid of a single hill, and is almost as flat as a sheet of glass. The western part of the Burdwan Division,

on the other hand, is hilly and uneven The rivers here have all the characteristics of mountain streams. The waters in the upper courses of the Damodar and Rupnarayan and their tributaries do not flow, but rush down the beds. The Damodar after passing the town of Burdwan and the Rupnarayan below its junction with the Silai flow comparatively through a level country, and at these places the currents receive an almost sudden check, resulting in an accumulation of water. Whenever therefore the rivers are full below these places, as is generally the case in the months of August and September if there be an unusually heavy and a sudden rainfall on the hills, floods more or less destructive are sure to occur. . The embankments originally intended to ward off these floods have served to increase the liability to inundation of places on the lower courses of these rivers. The silt that would have otherwise been spread over the banks is on account of these embankments for the most part laid on the beds, which in some places have in this way been raised to the level of the country beyond the embankments, if not higher, thus greatly reducing the water-carrying capacities of the channels on the one hand, and increasing the liability to inundation of the land on both sides on the other. The intensity of the flood also depends on the fulness of the river Hooghly at the time and the tidal currents. Should there be much and sudden rainfall in the hills during the middle of the rainy season when all the three rivers are full to the brim, and if especially this happens at or near a full or new moon, a destructive flood is unavoidable.

6.—FARM CROPS.

A list of farm crops of the Burdwan Division is given below, but except, perhaps, in one or two cases, it is not possible even to make a near guess at the area under each crop. Generally speaking, paddy is grown all over the division. Sugarcane is planted in small patches around the village sites. The oilseeds and pulses are mostly confined to the dearah lands. Mulberry cultivation has ceased in the Burdwan district, but it is still a crop of some importance in parts of the Midnapore and of the Beerbhoom districts. Jute is grown in the part of the division bordering on the Hooghly.

The new crops introduced in recent times, and the cultivation of which is extending, are potatoes, cabbages, Patna onions, sweet radishes, Chinese potatoes, and maize. Some plants of *sorghum vulgare* are met with here and there. The cultivation and manufacture of indigo is a declining industry in this division:—

Farm crops of the Burdwan Division.

1. Gramineæ ...	1. Paddy. 2. Sugarcane. 3. Wheat. 4. Barley. 5. Maize. 6. Deodhag.
2. Cyperaceæ ...	1. Madur kathi.
3. Liliaceæ ...	1. Onions. 2. Garlic.
4. Aroideæ ...	1. Kachu.
5. Dioscoreæ ...	1. Kham aloo.
6. Musaceæ ...	1. Plantain.
7. Zingiberaceæ	1. Ginger. 2. Turmeric.
8. Cannaceæ ...	1. Arrowroot.
9. Piperaceæ ...	1. Betel.
10. Euphorbiaceæ ...	1. Castor-oil.
11. Moreæ ...	1. Mulberry.
12. Sesameæ ...	1. Til.
13. Solaneæ ...	1. Potatoes. 2. Begun. 3. Chillies. 4. Tobacco.
14. Convolvulaceæ ..	1. Sakarkanda aloo.
15. Cucurbitaceæ	1. Patal. 2. Lau. 3. Kumra. 4. Uchche. 5. Jhinga. 6. Tarmuj. 7. Khero. 8. Sasha. 9. Futi. 10. Gomukh. 11. Kaukri.
16. Leguminosæ	1. Peas. 2. Kalai. 3. Mug. 4. Gram. 5. Mashuri. 6. Kheshari. 7. Arhar. 8. Rambha. 9. Sunn. 10. Indigo. 11. Dhaincha.
17. Lineæ ...	1. Linseed.
18. Tiliaceæ ...	1. Jute.
19. Malvaceæ ...	1. Kapas.
20. Cruciferæ ...	1. Mustard. 2. Cabbages. 3. Radishes.

7.—AGRICULTURAL IMPLEMENTS.

The implements the ryots use in their agricultural operations are few in number and very simple in construction. The following is a list of those in use in the Burdwan Division :—

1. Ordinary country plough (*langal*). The different parts of the plough are—

Mura, or body.	*Phāl*, or share.
Ish, or beam.	*Bonta*, or hilt.

The plough requires when at use a *noal* or yoke, and an *ajkra* or trace rope.

2. A smaller plough (*langal*) used for ploughing the aus paddy and maize fields when the plants are from 1 to 1½ feet high, to encourage tillering.

3. *Ladder* (*mai*)—This simple implement made of a piece of bamboo split in the middle, and with a few rounds of the same material, is used in (1) breaking the clods, (2) pressing the soil, (3) gathering the weeds, (4) levelling the ground, and (5) burying the seeds when sown.

4. *Bida*, or *harrow*.—This is simply a wooden bar about 4 feet long with a few bamboo or iron tines attached to it, and is used in (1) gathering weeds, (2) stirring the soil, and (3) thinning the plants. But its use is confined to places where aus paddy is grown by broadcasting the seeds.

5. *Phor*.—A weeding hook used in weeding and stirring the soil.

6. *Pashuni*.—Very much resembles an English hand hoe.

7. *Kodali*, or spade.

8. Sickle.

The *kodali* has of late become one of the most important implements of the agriculture in the division. It is in constant use in cultivation of potatoes, sugarcane, cabbages, &c. The cultivation of the newly-formed dearah lands is carried on almost exclusively by the *kodali*, which is the implement the ryots use when inversion of the soil or deep cultivation is needed. It is also made to do the work which in England is done by the ridging ploughs, broadshares, and hand and horse hoes. The *kodali* is made of different sizes and forms to suit different purposes.

The number of improved agricultural implements that have been tried in this division is very limited, and of these very few have met with any degree of success The Behea Sugarcane Mill is being more and more appreciated by the ryots, and is slowly superseding the old wooden screw. It is greatly to be regretted that the price of this useful implement is so high that few ryots can afford to buy it. The American plough, known as the Hindustan, has been tried with success by some of the well-to-do farmers and planters of the division, but at its present price it has no chance of being extensively used. The Bengal cast iron inverting plough which has recently been tried is said to have been favourably received by the ryots in the neighbourhood of Burrakar. At a place close to Patrasair, in the district of Bankoora, a system of irrigating paddy fields by steam-engine is under trial. It is altogether a new departure in Indian husbandry, and deserves special encouragement. In the Burdwan and the Hooghly districts, earthen pots are in general use for boiling cane juice into *gur*. Of late in some places these are being superseded by iron pans imported from Beerbhoom.

8.—WORKING ANIMALS.

The cattle of the Burdwan Division, like those of the rest of Bengal, seem to belong to a special breed, perhaps indigenous to this part of the country. How long the breed has been brought under domestication it is not possible to ascertain. In one of the islands in the mouth of the Meghna, there are to be found some animals belonging to this breed which have escaped human subjection and turned wild. Contrary to expectation, a free life and an abundant supply of fodder have not much improved either the size or strength of these beasts.

The breed on the whole has been kept pure, but in large towns and in Western Bengal some infusion of the blood of the Bhagulpore breed has taken place. The Bhagulpore milk cows are in demand in all the towns of Bengal. These give large quantities of milk, though rather poor in quality. Bullocks either imported direct from the Bhagulpore district or obtained from the issues of crossing between the indigenous and the Bhagulpore cattle are not

much valued in Bengal, and their use is almost exclusively confined to the cart. To work at the plough the indigenous is much preferred to the Bhagulpore breed. The large-bodied Bhagulpore animals eat quite two and half times as much as the indigenous bullocks, while only fifty per cent. more work is obtained from them. They are not again nearly so hardy as the poor-looking indigenous animals. Rearing of cattle for the production of meat is unknown even to Mahomedan ryots, who have no objection to taking beef. Among the Hindus a separate caste, known as the *goala* or cowman caste, systematically rear and manage milk cows, and sell fresh milk as well as its many preparations. Generally speaking, only as many animals are kept by a ryot as are just sufficient for the cultivation of his land, and the supply of a few ounces of milk for the family use. All the live stock that an average ryot possesses consist of a pair of bullocks, a milking cow and a calf. Sometimes one spare bullock is kept, but as often as not the cow and the calf are wanting. Considering the limited area of the ryots' holding, and the great want of grazing land in the country, it would not be advisable to increase the number of cattle. It may be as well to mention here that the density of the oxen population in Bengal is twice as great as in Great Britain. The latest agricultural returns show that the total number of cattle of all ages in Great Britain is about six millions, distributed over an area of 32,211,512 acres returned as being in agricultural occupation. This gives one ox to every 16 bighas of agricultural land. In Bengal the average size of the ryots' holding is about 15 bighas, and for this one pair of bullocks is kept, making one bullock to every 7½ bighas of cultivated land. This is without taking into consideration the cows and calves kept by the cultivators as well as by the milkmen. The calculation becomes complicated when sheep, pigs, and horses are introduced, but I suspect when this is done, it will be found that the ratio of the number of the live-stock to the area under cultivation is at least as high in India as in England. The superiority of England rests not on the number of its live-stock, but in their quality.

The breadth of land that can be worked with a pair of bullocks depends, of course, on the working capacity of the animals as well as on the nature of the soil, climate, and the crops grown. Where paddy is the only crop grown, a pair of good animals is considered sufficient for 20 to 25 bighas of land, and this represents the actual state of things in the western part of the division. In the east an average ryot possesses 15 bighas of land, and for this he keeps one pair of bullocks.

Generally the cattle in the west are superior to those in the east. The difference is probably due to a difference in the climate. A damp hot climate seems to have as great a deteriorating influence on cattle as on human beings. Clay seems to agree with the constitution of cattle better than a lighter soil, and this I do not think can be accounted for by the better herbage generally found on the former, for some of the clay land grows scarcely any grasses. Paddy straw grown on clay may be more nutritious than the same produced on a lighter soil. But this can only be ascertained by a long serious of chemical analyses and physiological experiments.

In some of the places in the west of the division buffaloes are much used as working animals. They are much stronger than oxen, and do the work much quicker, but they cannot stand heat. In the summer after 8-30 or 9 o'clock suffering from effects of the heat they become quite unmanageable.

9.—AGRICULTURAL SERVANTS AND LABOURERS.

Where paddy is the only crop raised one man is needed for every 10 bighas of land, and this I think is approximately the ratio of the number of agricultural workmen to the area under cultivation in the western part of the division. In the east, where potatoes, sugarcane, onions, &c., requiring spade cultivation are largely grown, the ratio is much greater. It may be of interest to mention here that clay land in Bengal requires less work both from the cultivator and his bullocks than a lighter soil. This apparent anomaly is explained by the fact that clay land produces only paddy, and the only preparation it generally receives is two or three ploughings in June to work it into mud, in which the paddy seedlings are planted, while up land grows more than one crop in the year, and the land has to be pulverised by more frequent ploughings for each crop.

The ryots do not, generally speaking, keep any permanent servants. The only extra labour they ordinarily employ is at the time of planting and reaping paddy. In the Beerbhoom and the Bankoora districts, however, there are many well-to-do farmers holding from 30 to 80 bighas and hired labourers are more extensively employed by them. In Beerbhoom an agricultural servant gets a third part of the produce of the land cultivated by him. Assuming that one man works about 10 bighas of paddy land, and that the average yield of paddy per bigha is about 12 maunds of grain and 10 *pons* of straw, 40 maunds of paddy and 33 pons of straw; worth about Rs. 48, falls to the servant's share. This gives a monthly salary of Rs. 4. Where this mode of payment obtains, it is customary for the master to lend the servant all the paddy he wants for himself and his family throughout the year, and to deduct the amount so lent from what falls to the servant's share when accounts are settled between the master and the servant at the end of the harvest season. As a rule, the servant does not get enough to pay off his old debts. This system on a much larger scale is prevalent in some parts of the Nuddea district, and it has been found that where it prevails, the labourers are in a poor condition as compared with labourers elsewhere. In other parts of the district where the system does not prevail, the average monthly salary of an agricultural servant is Rs. 6; in some places as much as Rs. 7-8. The servants are paid either wholly in cash, or partly in cash and partly by food and clothing. A day labourer gets from 3 to 5 annas per diem. At planting and harvest time wages increase by 20 to 50 per cent.

10.—MANURES.

Manures are pretty largely used in the Burdwan Division. In some places few fields can be found which receive no manure whatever, while no ryot would dream of growing without manure such crops as sugarcane, potatoes, onions, &c.

The manures generally used are—

(1) Cowdung.
(2) Cowdung ashes.
(3) Oil-cakes—(*a*) castor cake, (*b*) mustard cake.
(4) Pond mud.
(5) Hide salt.

(1) *Cowdung.*—This manure is to some extent wasted by using it as fuel, but such is not the practice everywhere. In Beerbhoom, for example, no good cultivator would think of using his cowdung as fuel. Cowdung is considered *the* manure, and the Bengali term for manure used by the ryots is synonymous with cowdung. An idea may be formed of the high appreciation by the cultivators of the western part of the division of this important manure from the rural saying *sar sattwa Lakshmi*—the goddess of fortune resides in cowdung. Every ryot has his dung-heap. Close to the cowshed a piece of low ground is selected or a hole is made for the collection of the daily supply of dung, dung ashes, wood ashes, waste straw, refuse of vegetables, and in fact everything that, in the opinion of the ryot, has the least manurial value. The manure of the dung heap is more a compost than farmyard manure. The bottom and sides of the hole are never well pressed and plastered with clay. Sometimes the heap is very carelessly managed; it is allowed to become too dry, and rain water often washes away the most soluble and the best portion of the manure. No sort of litter is used, and urine—the most valuable portion of cattle manure—is allowed to soak into the mud floor of the cowshed. The earth of this floor, however, is dug out occasionally and used as a manure. It is much prized, and is used in the nursery for paddy, *begun*, onions, &c.

Cowdung is used to a more or less extent on all the crops, excepting perhaps the pulses. It is to be noted that cowdung, unless well-rotten and old, is not considered by the ryots to be a good manure for many valuable crops. It is supposed to spoil the quality of potatoes and sugarcane juice. When applied to *begun* the plant is supposed to grow too luxuriant to give much fruit. It

is used more largely in the clay soils of the western part of the division than in the comparatively lighter soils of the east.

Cowdung is allowed to collect in the dung heap from June till March April and May are the two months when it is carried to the fields. In places where potatoes are grown it is also applied to the fields in August and September. It is carried to the fields either on carts or on pack bullocks, sometimes also in bags or baskets placed on the heads of the ryots themselves, and is first put in heaps at regular intervals, as is done in England, and then spread over the fields either by the hand or by means of the *kodali*.

As regards the quantities used per bigha for different crops, there is no uniformity of practice, the quantity depends entirely on the number of cattle kept by the ryot and his means to buy more from his poorer neighbours Only. very limited quantities of dung can be bought, for nobody sells it, excepting the poorest of ryots and milkmen who are not themselves cultivators. Whenever it is sold the price demanded is very low compared with its great manurial value.

The following list will give a rough idea of the quantities applied to some of the most important crops :—

Names of crops.	Quantities applied per acre.
(1) Aus dhan	2,250lbs.
(2) Aman dhan	2,250 ,,
(3) Sugarcane	6,000 ,,
(4) Potatoes	6,000 ,,

The ryots are aware that the richness of the dung depends on the nature of the food given to the cattle, hence dung of cattle fed with oil-cake is highly prized by them.

The amount of dung that is wasted by using it as fuel, or more accurately the quantities of nitrogen and organic matter that are lost in the burning of the dung throughout the country, would be very difficult, if not impossible, to ascertain; but it is important to note that even if all the dung and urine of cattle were carefully collected and spread over the cultivated area in the most economical way possible, the amount would still be found insufficient to meet the requirements of the land.

(2) *Cowdung ashes* are generally thrown into the dung heap, but sometimes it is separately used in onion fields and nurseries.

(3) *Oil-cake.*—This manure is now very largely used, especially in potatoe, sugarcane, ginger, and cabbage fields. Sometimes it is applied in quantities that would be considered pretty heavy dressing even in England. Castor cake is regarded as much more powerful than mustard cake. When the vegetative part of the crops is the most important, the former is used and the latter when seeds and fruits are required to be increased. It is important to notice here that oil-cakes finely powdered are generally applied as a top dressing just before the plants are in need of any extra food. The rapidity with which oil-cakes, and especially castor cakes rich in nitrogenous matter, decompose when applied to the land is most astonishing.

(4) *Pond mud*—Is considered a very valuable manure, and is applicable to all crops. I have seen splendid crops of paddy being raised by this manure. But the crops to which pond mud is most commonly applied are betel, mulberry, and plantain. To obtain the best results it is necessary to apply it in very large quantities. A good dressing would be 40 cart loads per bigha. The sort of mud most valued is the bluish black mud which, when dry, possesses a slaty cleavage. It is not always properly dried and ærated before mixing with the soil, and the evil effect of carelessness in this respect is sometimes seen in paddy planted in fields in which a large quantity of fresh mud has been applied which often consequently suffers from what is regarded as a disease, known as *kadamara*

The beneficial effects of pond mud last for three years, and manifest themselves most the second year. Pond mud is most extensively applied in a year of drought when the ponds and tanks dry up.

(5) *Hide salt.*—In hide salt Indian ryots have a very cheap nitrogenous manure. The nitrogen is in a form in which it can be easily taken up by plants, and as it is mixed with common salt, one of the injurious effects of using too much nitrogenous manure, viz., the over-growth of leaves, is to a great extent checked. But it is not much used by the ryots, as it is regarded as a very exhausting manure. It is used only when paddy has been suffering from *kadamara*, when five seers of hide salt is sown over a bigha of land the soil being turned over by the *kodali*.

(6) *Green manuring.*—Green manuring, of which so much has been written, is well known, and is practiced among a limited portion of the ryots of Hooghly and Burdwan. The plants used by them all belong to the *leguminosæ*, viz., *dhaincha*, *sunn* and indigo, the last being used only in potato fields,—a fact which shows that from experience alone the ryots have discovered more than merely the principle of green manuring. Weeds are sometimes used to enrich the soil exactly on the same principle. Whenever possible, instead of weeding the fields the soil is turned up with the *kodali*, the weeds being buried under it. Every cultivator of clay land is aware of the fact, that the paddy crop on such soil is dependent on the luxuriant growth of weeds in the month of June, which are ploughed in before planting the seedlings.

(7) *Horn shavings.*—I have seen this manure used only in one village in the Burdwan district. Its effect on paddy shews that in consideration of the different climatic conditions under which Indian agriculture is carried on, many of our ideas regarding the uses and effects of manures, founded on agricultural operations of Western countries, have to be greatly modified. In Johnston's Elements of Agricultural Chemistry we read "horns and similar substances remain for years undecomposed in soil, and therefore they are of little value if means be not adopted to hasten their decomposition. Made into composts, it requires several years before they are converted into soluble manures." In Bengal it has been found that if applied in May, this manure in a month or two it is rendered sufficiently soluble to have a decided effect on paddy even in the first stage of its growth.

FODDER AND FUEL SUPPLY.

With regard to the fodder and fuel supply, the division may be divided into three parts, the conditions of which in this respect materially differ, namely, (1), the western part. (2) the eastern part, and (3) the dearah lands.

(1) *The western part.*—This comprises a little over one-third of the division. The soil is chiefly laterite clay, in places very shallow. The country is hilly and uneven, and the hills are mostly devoid of any vegetation: the *sal* forests with which most of them were once clothed have all been cleared away. In a few places vestiges of these forests are still met with, but the area covered by trees is being yearly reduced. The natural grasses growing here are few in number, and the amount of fodder supplied by them is exceedingly small. But the land is very thinly populated. The cultivation is restricted to growing paddy, excepting in places on the banks of the principal hill streams. Compared with the area under cultivation, the cattle kept are few in number, and unless in years of unusual drought resulting in the failure of paddy, the straw annually obtained, though partly used for thatching, supplies sufficient food for the working bullocks and buffaloes and the milking cows.

(2) *The rest of the division excepting the dearah lands.*—This part grows more grasses than the area included in (1), but it is one of the most populous localities in India. In some places the density of population is the greatest in the world. The number of cattle kept is exceedingly great The whole of the cultivable land has been brought under the plough. The pressure of population is such that no land which is in any way fit for cultivation can be spared for the grazing of cattle or for raising any crop specially meant to supply food for them. The working animals are weaker than in the west. The paddy straw, which forms their most important, if not the only food, is partly used for thatching in villages as well as in the towns. A portion of the straw is also consumed by bullocks doing other than agricultural work: The number of such animals is yearly increasing, and as the owners of these bullocks are willing and quite able to pay very high prices, a considerable portion of the best straw finds its way

into towns. A further portion of this valuable article is also drawn away from the division and sold in the Calcutta markets. All these causes combine to render the fodder supply of this part of the division far short of the amount required even in ordinary years.

(3) *The dearah lands.*—This is the part of the division which produces the largest amount of grasses. In *babul*, *jhan*, and different kinds of reeds grown here, there is also an abundant supply of fuel. The land is comparatively thinly populated, and the number of cattle kept is not excessive. The supply of fodder is therefore in excess of the local demand, but the surplus, instead of finding its way into the second part of the division, is sent to the Calcutta markets.

System of grazing.

With a single exception to be noticed below, hay-making is unknown here. Whatever little grass is available is either grazed by the cattle, or cut and given them green. The system of cattle grazing followed here—and it is the same all over Bengal—is most wasteful. The grazing grounds, wherever these exist, and the fields are never protected by fences, and the cattle are at liberty to roam over them at any time without the least restriction. Grasses are thus given no opportunities to grow: a continuous struggle is going on between them attempting to raise their heads and the cattle trying to keep them down, and in this unequal fight the tender grasses always get the worst of it, excepting during the rains, when nature lends them her helping hand.

Hay making.

The one exception mentioned above to the general rule that no grass is preserved for food in favor of hay occurs in the newly-formed alluvial lands near Culna, where hay is made and sent to the Calcutta market for sale. The grasses after being cut with a hand hoe are kept in heaps for two or three days. They are then dried in thin layers and made into small sheaves, weighing a little over ¼lb. Owing to the careless way in which the hay is made, the colour is much spoilt.

It should be mentioned here that the real difficulty in connection with the fodder supply of the division is not the want of a proper method of preserving the fodder already available, but how to increase the amount of that fodder, which is hardly sufficient even in a year of prosperity. If we exclude from our consideration the limited area comprising banks and dry beds of rivers, canal embankments, and lands enclosed within railway fencings and dearah lands, at no time of the year does any part of the division grow more grass than is just sufficient for the time being.

12.—ROTATION OF CROPS.

The fact that if the same crop be repeatedly grown on the same field the outturn will be more and more reduced is well known to the Indian cultivators. But they make an exception in case of paddy. It is a general belief among the ryots that paddy instead of exhausting the land improves it. This belief is probably founded on the fact that for bringing a newly-broken soil to condition, paddy is one of the best crops. Potatoes also, which are very highly manured, are supposed to do better when planted on the same field continuously. This belief is, no doubt, due to the ease with which the field may be worked if potatoes are raised on the same land year after year The ryots also know that certain crops are very exhausting and can be grown only at long intervals. It is likewise known to them that a cereal crop after one of peas, and potatoes after *sunn*, do very well. But it cannot be said that they follow any regular system of rotation of crops. The condition of the field at the time, the state of the weather, the demand in the market, the means of the cultivators, are the considerations that determine the particular crop to be put in. The general custom is to grow paddy after paddy on the low-lying lands, and on the higher grounds surrounding the village sites to grow *aus* paddy in the rainy season, and one of the pulses as a winter crop. Potatoes, onions, &c., sometimes take the place of the pulses. Sugarcane is a special crop requiring a full year to ripe, and is grown at intervals of three or four years.

13.—HARVESTING AND THRESHING.

The crops are harvested generally by the cultivators themselves without the aid of hired laborers. In some places the neighbouring cultivators combine

and gather in the harvest of all the fields belonging to one after another as each happens to be ready. This system is known as the *ganti*. Day-labourers are sometimes engaged, and are paid mostly in cash.

The implements used in harvesting are the sickle, *kodali* and *dao*. The pulses and linseed are pulled up by the hand.

One man can reap one-third bigha of paddy in a working day of 7 hours.

Threshings.

To remove the grain from the straw three different methods are adopted,—1*st*, the crops are trodden by bullocks; 2*nd*, beaten by a stick; 3*rd* struck against a plank.

For the threshing floor a plot of ground as nearly level as possible is selected in a convenient position, generally close to the homesteads. It is then cleaned and smoothed by a *kodali*, and plastered with mud and dung.

Excepting *amun* paddy, which is sometimes stacked, all the other crops are threshed as soon as they have been dried for a few days on the threshing-floor.

(1) In the middle of the threshing-floor a pole is fixed, and round this is spread the crop to be threshed, in a uniformly thick layer. A number of bullocks—four to six are generally taken—are tied in a line by a rope, one end of which is attached to the pole. Round this pole the bullocks are made to walk treading on the straw. The services of two men are required for carrying on the operation—one to guide the bullocks, and another to turn over the straw and spread it properly. In three hours the produce of half a bigha of paddy can be threshed in this way.

(2) The method of beating out the grain with a stick is resorted to when only a few handfuls of the crop require to be threshed.

(3) In the greater part of the division paddy straw is almost the only material available for thatching. Straw threshed by the first method becomes unfit to be used this way. The third mode of threshing mentioned above is therefore generally adopted in case of paddy when the straw is intended for thatching or sale. The sheaves are one after another struck against a wooden plank rectangular or circular in form, and placed in an inclined position. The grain falls beneath the plank, and the straw is thrown away into the straw heap. Instead of a wooden plank, a bamboo platform is in some places used, which gives work to 20 to 25 men at the same time. One man can in this way thresh out the produce of half a bigha a day.

Winnowing is done by letting the grain and the chaff fall from a basket held at some height from the ground against a gentle wind.

14.—RURAL ECONOMY.

With the time and means at my disposal, it has not been possible to collect agricultural statistics, but some information on the subject will be given under Appendix II, from which a fair idea could be formed of the rural economy of a typical village in the Burdwan district. Great pains have been taken to make the account complete and as accurate as possible. The figures given are the results of actual counting.

CHAPTER II.—FARM CROPS OF THE BURDWAN DIVISION.

It will be noticed that in describing the modes of cultivation of the different farm crops of the division, I have avoided as much as possible all mere general statements which are of little practical use. What I have attempted here is to give under each crop a detailed account of such facts as one intending to take to agriculture as a profession would wish to be in possession of. In fact I have studied the subject from the point of view of an agricultural student and practical agriculturist, and not from that of an administrative officer.

I.—GRAMINEÆ.

I.—Paddy.

Paddy is by far the most important crop of the division. There are very large areas, especially in the western part of it, that grow nothing but paddy.

All the different varieties of paddy cultivated in Bengal may be grouped under three primary classes distinguished from one another by marked characteristics—(1) the *aus* or early, (2) the *amun* or late, and (3) the *boro*. (1 The *aus* is a coarse variety difficult to digest and eaten by the poorer classes alone. It is grown on highlands, and requires much less water than the other two classes. When sown broadcast, as is the general practice, it is a good deal more troublesome to grow than the *amun*. It also yields a smaller outturn and fetches a lower price. But it supplies the ryot with a food-grain and his cattle with fodder at a time of the year when both are very scarce. It is also off the field early enough to permit of preparation of the land for the *rabbi* crops, the winter vegetables, including potatoes or sugarcane. (2) The *amun* class includes most of the varieties of paddy, and is grown over a larger area than any other crop. It is cultivated on low lands with a clay soil, and requires much more water than the *aus*. The finest varieties of paddy belong to this class. (3) The *boro* is a coarse paddy, some of the varieties being the coarsest known. It is less nutritious than the other varieties. It is grown on soft mud on the sides of rivers, canals, or lakes. Edges of rivers subjected to strong tides are of all places the most suited to growing this class of paddy.

Classes.

It would serve no useful purpose to enumerate the more than one thousand different varieties of paddy grown in this division. Almost every considerable village has a variety of its own, and every year sees the extinction of some of the old varieties and the appearance of some not known before. Paddy is perhaps the best instance known of the variations which plants have undergone under cultivation. Originally an aquatic grass, the one characteristic which it has most persistently retained amidst all the changes brought about by differences in climate, soil, and mode of cultivation is the need of a large quantity of water for its proper growth. According to the popular saying, "*dhan pan nelya snan*"—paddy and betel should have a bath every day. It is the belief of the ryots that give the paddy but this one thing needful, and it will grow in any soil and under any climate. Indeed, the facility with which it adapts itself to the different classes of soil from the stiffest clay to the lightest of sands, and from the peaty to the saline, is simply wonderful. Compared with the advantages of a proper supply of water, all other questions in its cultivation, namely the quality of the seed used, the nature of the soil on which it is grown, the manures applied, and the mode of cultivation adopted, are things of very minor importance.

Varieties.

1 (*a*).—AUS PADDY.

The high lands on which *aus* paddy is grown generally produce two crops in the year. As soon as the paddy has been gathered, the field is prepared for one of the *rabbi* crops; in this part of the country one of the pulses or oilseeds.

Rotation.

In dearah lands the paddy is sometimes followed by wheat or barley. Potatoes and *aus* paddy form a rotation in some places.

On such lands *aus* paddy is the only rain crop grown excepting in jute-growing districts, where the following rotation is generally adopted :—

First year	...	1. *Aus* paddy. 2. One of the pulses or oilseeds, or the two mixed together.
Second year	...	3. Jute. 4. One of the pulses or oilseeds, or the two mixed together.

Sugarcane is grown on *aus* land, but it is not a rotation crop. It takes a ful year to mature, and can be grown only at long intervals, say every third or fourth year, the crop which precedes and follows it being paddy.

Aus paddy is one of the best cleaning crops and is often grown as such. If an orchard is to be made or plantains are to be grown, it is on the standing *aus* paddy that the trees are generally planted. When this plan is not adopted, it becomes sometimes extremely difficult to put down the weeds, specially the *ulu* (*saccharum cylindricum*).

Aus manures

Aus lands are almost always manured excepting those near large rivers which receive a yearly deposit of silt. The manures generally used are cowdung, ashes, pond mud, and oil-cake. There is no uniformity as regards the quantities in which these are applied, the quantity depending more on the means of the ryots than the requirements of the crop or the field. Then again, as the same field generally gives two crops in the year, it is difficult to say how much of the benefit of the manure is appropriated by the paddy. The practice generally is to apply as much of the dung as possible before paddy is put in, and to let the crop following it be benefited by the residuum of the manure after paddy has taken its share. This plan is adopted because to such crops as the pulses, potatoes, &c., direct application of the dung is not good, and in some cases it is positively injurious. Again, when paddy follows the potatoe crop, which receives a heavy dressing of oil-cake, any fresh application of manure is not necessary. When oil-cake is applied to paddy, the usual quantity is one maund per bigha. Pond mud is available only in particular localities, and is not applied more frequently than once in three or four years, the quantity varying between ten and forty cart-loads per bigha.

Aus soil.

Aus is generally grown on sandy soils, but does best on loam.

Aus tillage.

As soon as the previous crop of paddy is off the field, the land should be ploughed twice, once along and once across the field. Practically the ploughings do not begin till the beginning of Falgoon (15th February to 15th March), unless the paddy is to be followed by one of the *rabbi* crops or potatoes. In some places the first ploughing is delayed till the end of Choitra (15th April). The cultivators are well aware of the advantages of early ploughing in the case of *aus* or upland. All through the winter and summer till the first fortnight of Bysack (15th to 30th April) the great object the ryots have in view in ploughing their paddy fields is to expose them to sun and air as much as possible. This is done by ploughing the fields at intervals of a fortnight or so and leaving them in open furrows. The ladder is seldom used at this time of the year. Another object of these frequent ploughings is to eradicate the weeds, and the cultivators know that a few more ploughings now will save them a good deal of trouble afterwards. Altogether seven or eight ploughings are given in this way. By the middle of Bysack the fields get well dried, and the roots of grasses are destroyed by the burning heat of summer. Now, taking advantage of a somewhat heavy rain, the clods are broken up by passing the ladder once or twice over them. Five or six days before sowing the seed the field should be once ploughed, and moisture necessary for proper germination is retained by pressing the soil with the ladder.

Aus sowing.

The ryots in the Burdwan Division have no implements to drill in the seed which is generally broadcasted. In the case of paddy, however, the general tendency now is to do away with broadcasting, and to transplant the seedlings instead. Transplanting takes a longer time than broadcasting, and as from want of timely rains seedlings for the *aus* paddy are often difficult to obtain in time, broadcasting is sometimes a necessity.

On the day of sowing the field is ploughed, and then levelled well with the ladder. After the seeds have been broadcasted they are ploughed in, and the operation is finished by rolling the field once with the ladder. The usual time for sowing *aus* paddy is the beginning of Jaista (latter half of May). Ten to twelve seers of paddy are sown per bigha In order that the seeds may be uniformly distributed over the land, they are sown in two lots: once along and once across the field.

After-treatment.

The plants come out in four or five days. When they have grown to a height of about nine inches or so, it is well to take advantage of a shower of rain and harrow the field. The tines of the harrow will root out a good many weeds, and those which escape the harrow should be pulled out by the weeding hook. If there be little weeds one harrowing will suffice, otherwise it will be necessary to harrow and cross harrow the field. Fields of which the ploughings have been previously neglected will give much trouble in eradicating the weeds. Sometimes so many

as three weedings will be needed, and weeding is a most tedious and expensive operation. When the clumps begin to form by the tillering of the plants, about an inch of water should be collected in the field, and the *langla*, or the smaller plough, should be lightly passed over it. This will greatly increase the growth of the plants, and they will tiller much better. The ploughing will not injure the plants; those that have been buried in will soon push themselves up. In backward fields a top dressing with oil-cake at the rate of one maund per bigha generally precedes this ploughing. When the field is situated on a high ground, and there is no pond or any other reservoir of water close by, instead of ploughing, the soil should be turned up by the *kodali*. Sometimes owing to the seeds not having been uniformly sown, or from other causes, there are too many plants in some parts of the field and too few in others. This is rectified to a certain extent by pulling out some of the plants where they are too thick, and transplanting them where they are too thin. This operation is known as *bagrachi* or *gachhana*. When the plants begin to form ears water should not be wanting in the field, and if the rain does not help in this, artificial irrigation is resorted to. About this time a weeding is sometimes needed and given.

Aus harvest.

The harvest time for *aus* paddy extends from the last week of Bhadra to the second week of Aswin (last three weeks of September). The *aus* paddy is harvested while yet slightly green, for if allowed to ripen fully, it will shed some of the grain, and *aus* straw being brittle, will get broken. *Aus* paddy again, excepting what the ryots keep for seed, is intended for immediate consumption. The reaping implement used is the sickle. *Aus* paddy is cut close to the ground and laid in the field in parallel lines for nearly a week. It is afterwards made into sheaves and taken to the threshing-floor, or put in heaps of some 100 to 150 sheaves each, the tops and sides of which are carefuly smoothed to let rain water escape easily without penetrating into them.

Aus yield.

The outturn per bigha varies from 4 to 8 maunds of grain and 3 to 7 pons of straw.

Aus diseases, &c.

Heavy rains are injurious to *aus* paddy. A kind of black insect resembling the common mosquito sometimes eats away the cellular tissue of the leaves.

COST OF CULTIVATION.

	Rs.	A.	P.
Ploughing 8 to 9 times	3	3	0
40 baskets of dung	1	0	0
2 men to carry and spread the same	0	8	0
12 seers of seed paddy	0	5	0
Harrowing	0	2	0
Weeding 5 men	1	8	0
Passing the langla	0	4	0
Weeding a second time 3 men	0	15	0
Reaping 2 men	0	10	0
To bind and carry 3 men...	0	15	0
Threshing 1 man	0	5	0
Rent for 9 months	1	8	0
Total ...	11	3	0
Yield 8 maunds of grains	7	0	0
Straw 8 pons	1	8	0
Total ...	8	8	0

It would appear from these figures that the cultivation of *aus* paddy does not pay as a commercial speculation, but it is to be remembered that *aus* is produced principally for home consumption, that another crop is got off the same land in the same year, and that in the above calculation the ordinary wages of labour are allowed at 4 or 5 annas per day, while the cultivation is really carried on by the ryot and his family, and that *aus* supplies him with food and his cattle with fodder at a time when both are scarce.

Instead of broadcasting the seeds, *aus* is sometimes transplanted,

In this case the cultivation is much simpler and cheaper. For the preparation of the field fewer ploughings suffice. Ordinarily six ploughings are given: four when the land is dry and two in the mud.

Aus nursery.

For the nursery a plot of ground is chosen either in a corner of the field itself or in a place where water is available close at hand. This is carefully ploughed and pulverised, due attention being paid to exposing the soil to sun and air. It is also heavily manured with well-rotten dung and ashes. For sowing the seeds advantage is taken of a slight rain, or the moisture necessary for the propee germination of seeds is given by artificial irrigation A maund of paddy is sown broadcast on a bigha of land. Sometimes a little more. The field must not be watered after sowing, for this will cause the soil to sink and cake, which greatly interferes with the proper germination of seeds The seedlings are ready for transplantation when they are about a foot high. They may be pulled out either with or without previously watering the ground. After the seedlings have been taken out they should have their roots well washed. They are then made into bundles, each bundle containing as many plants as can be grasped with both hands and kept floating in water. The seedlings may be transplanted either on the day they have been pulled out or the day after, further delay being, according to some, injurious. But on this point opinions differ. Some think that the seedlings should never be planted fresh, and they can be kept for three or four days without being any the worse for it. One bigha of land will require 60 to 70 bundles of seedlings, and this is the produce of about 2 cottahs.

Transplanting.

In Ashar (second half of June and first of July) water should be collected in the field, which should be ploughed twice. If the soil is clay, the ladder is passed once or twice. This serves to level the field as well as to bury in the weeds. The ladder need not be passed over a sandy soil.

The seedlings are planted in the soft mud at a distance of ½ to ¾ cubit from one another, four to five seedlings being placed in the same place

Turning the soil.

The only other operation to be gone through besides harvesting is to turn up the soil by the *kodali* when the plants begin to tiller.

Cost of cultivation of aus transplanted.

	Rs.	A.	P.
6 ploughings	2	4	0
2 men to pull out the seedlings and plant them in the field ...	0	10	0
6 seers of seeds	0	3	0
Turning up the soil 4 men	1	4	0
1 maund of oilcake	1	2	0
Reaping 2 men	0	10	0
To bind and carry 2 men	0	10	0
Threshing 2 men	0	10	0
Rent for 9 months	1	8	0
Nursery	0	10	0
Total ...	9	7	0
Yield—grain 8 maunds...	7	0	0
Straw (of better quality than when broadcasted) ...	1	12	0
Total ...	8	12	0

N B.—There are a few varieties of paddy, *niali, kele, aswingota, kartiksal,* &c., which form a sort of connecting link between the *aus* and the *amun* These are all transplanted like *amun*, and require more water than the *aus* The time of transplanting is a little later than that of *aus*, and they are reaped one to two months before *amun* is ready for the harvest.

1 (*b*).—*The Amun Paddy.*

Soil

As stated before, *amun* paddy is grown on lowlying lands, generally clayey. It requires such a large quantity of water that high lands, unless situated very close to tanks, canals, or any other reservoirs of water, are not suited to growing this class

of paddy. Some of the best varieties require a clay soil and about one and a half feet of water almost from the time of planting to the harvest time.

The method of cultivation differs according to the comparative height of the land to be sown with *amun* paddy, that is, according as it is situated just below the *aus* land or situated lower down remaining under water for the greater part of the year. In the first case the land is generally loam. The paddy is either sown broadcast or transplanted. In the other case the soil is almost invariably clay, and transplantation is the general rule.

First case where amun paddy is sown broadcast.

After the previous crop of paddy has been harvested, the first shower of rain is taken advantage of in giving the land one or two ploughings. This is generally done in Magh (15th January to 15th February). If the field be unclean and full of weeds, one more ploughing is given in Falgun or Chaitra (March or April), otherwise the field is left untouched till the beginning of the rainy season. At the end of Baisakh or the beginning of Jaistya (middle of May), after giving one or two ploughings, the seed is sown broadcast at the rate of 10 seers per bigha. It is ploughed in and the sowing is finished by passing the ladder over the field once or twice. Sometimes the sowing is not preceded by any ploughing, but after the seeds have been broadcasted the field is ploughed twice : once along and once across.

The only other operation before reaping is weeding. Generally one weeding is sufficient, but sometimes two to three weedings will be needed. Thinning the plants takes place along with the first weeding. This is, however, not the case everywhere. In some places the after treatment of broadcasted *amun* paddy is very much like that of broadcasted *aus*. When the plants are about seven or eight inches high, the field is twice lightly ploughed with the *langla* or smaller plough at intervals of about a week. After the second ploughing the ladder is passed over the ground once. These ploughings are followed by weedings. Two weedings are generally given. Transplantation from one part of the field to another is sometimes necessary.

Second case where amun paddy is transplanted.

The lowlying clay lands receive very little tillage. Some cultivators are of opinion that these lands ought not to be ploughed in summer, for, by ploughing, grasses will be destroyed, and the success of the paddy is dependent on the growth of these grasses. In Baisakh (15th April to 15th May), after a heavy shower of rain, the land may be once ploughed, while the soil contains still a large amount of water. This ploughing of the wet land instead of destroying the grasses will encourage their growth. At the end of Jaistya or in Ashar, when the land has been quite saturated with moisture, the embankments of the field should be repaired and water collected in it. By two or three ploughings the grasses should be mixed up with the mud, and the seedlings of paddy planted in. There is no doubt some truth in the statement that grasses serve the purpose of green manuring, but that this is a one-sided view of the matter is evident from the fact of paddy grown on lands which are not early ploughed, being often subjected to what the cultivators call the disease of *kadamara*.

Practically such lands receive no treatment whatever till the first or second week of Ashar (latter half of June) when the clay, softened by frequent heavy rains, is made into mud by one or two ploughings. Five or six days after this, the ladder is used once, and then more ploughings are given, when the field is ready for the transplantation of seedlings.

Nursery, &c.

The mode of preparing the nursery, the pulling up of the seedlings, and transplanting them in the field are exactly the same as in the case of *aus* paddy grown by transplantation. But in case of *amun* paddy all these operations are done much later in the season.

Time of sowing seeds in the nursery ...	Jaistya and Ashar (middle of May to middle of July).
Time of transplantation ...	Ashar and Sravan (middle of June to middle of August).

The only other operation gone through on the field till the harvest time comes is to weed the field two or three times.

Being a crop of the rainy season, amun rice does not generally require artificial irrigation. In Kartick (October 15th to November 15th), just before the plants begin to blossom, artificial irrigation is sometimes necessary.

Manures.

In some places where the cultivators are more intelligent, *amun* lands almost invariably receive some dung, generally at the rate of 20 baskets per bigha. Some well-to-do ryots in this division sow broadcast on the mud about a maund of oil-cake per bigha just before transplanting the seedlings—a practice which, so far as I know, only prevails in the Burdwan Division, and which might with advantage be encouraged and introduced elsewhere.

Diseases.

Injury is sometimes done to *amun* paddy by insects. (1) one called *Shanki poka* eats away the tender leaves of the young plant. This insect disappears as soon as the heavy rains set in. (2) At this stage of its growth the plant is also sometimes attacked by a mosquito-like insect, the same little creature that feeds on the *aus* paddy. (3) A black fly also occasionally attacks paddy when the ears are being formed. It sucks in the milky juice of the soft grains. These flies sometimes come in immense numbers: 50 to 100 flies may be counted on a single ear. (4) *amun* paddy often suffers from *kadamara*. In a year of excessive rainfall, and when the field has not been properly ploughed, mosses likewise do injury to this crop.

Harvest.

The processes of harvesting and threshing of *amun* paddy are very much the same as of *aus* paddy. *Amun* paddy after being harvested may either be threshed as soon as the plants have dried by a few days keeping, or stacked.

Cost of cultivation :—

	Rs.	A.	P.
20 bags of dung	1	4	0
To spread the same	0	6	0
Four ploughings at 6 annas each	1	8	0
Planting 2 men	0	8	0
* Weeding 2 men	0	8	0
Reaping	0	12	0
Binding and threshing	1	4	0
Nursery	0	10	0
Rent	2	0	0
Total ...	8	12	0

	Rs.
Yield—10 maunds of paddy grain	10
10 pons of straw	2
Total ...	12

* Sometimes more than Rs. is spent on this head.

In clay soils somewhat more of grain and a little less of straw are obtained than what is given above. In part III will be found the suggestions which occur to me for the improvement in cultivation of this the most important of all crops in Bengal.

1 (*c*)—*Boro Paddy.*

This class of rice crop is not extensively grown in the Burdwan Division. Its cultivation is confined to the south-eastern part of the division, the southern extremity of the Hooghly and the Midnapore districts, and even in these places the cultivation of *boro* paddy assumes importance only in years in which the *amun* paddy has been wholly or partially destroyed by floods. The following is an account of the way the cultivation of *boro* is carried on in the Ghatal sub-division.

Two different crops of *boro* may be obtained in a year. It may be cultivated either as a winter or a rain crop.

When it is grown as a winter crop two different methods are adopted, and according as the one or the other of these methods is followed, the *boro* is termed the *kalpina boro* or the *chata boro*.

Tillage operation — There is not much tillage required in the cultivation of this class of paddy.

(1). *Kalpina boro.*—When *boro* is planted in lowlying fields in which water left by the overflow of rivers is still standing in the beginning of Agrahayan, it is termed *kalpina boro*. If the ground is in the form of soft mud, which is generally the case with such lands, no ploughing is needed. The only thing to be done for the preparation of the ground is to remove the aquatic grasses that generally grow in such places and bury them in the soil to serve as green manuring. If the ground is not quite soft, one or two ploughings are given.

(2). *Chatá boro.*—When boro is grown on dry lands with the aid of artificial irrigation, it is termed *chatá boro*. The embankments on the lower ides of the field are repaired and water is collected. The land is then ploughed twice as in the cultivation of *amun* paddy, and the field is ready for transplantation.

Nursery. — The seeds are first sown in a nursery. For this purpose a plot of ground is generally selected containing soft silt brought down by the flood. The water standing on it is removed and the ground is levelled by passing over it several times the stalk of a palm leaf. If such ground cannot be had, a plot of land is flooded artificially and is ploughed several times, and then the water is removed if there be any standing on it. The seeds are sown on the soft mud, but not when water is standing on it. The grain requires to be carefully prepared before sowing in the nursery. It is a peculiarity of this class of paddy that only newly-threshed grain will germinate properly. For three days and nights the grain is alternately dried in the sun and exposed to the night dews. It is then put in a bag, which is kept under water all the night and dried all the day. This process is repeated for three days and nights. If the seeds have all germinated by this time, they are immediately sown. Otherwise they are filled into a bag and covered with blankets. After a day or two the seeds are taken out and broadcasted in the nursery at the rate of 50 seers per bigha. The seedlings obtained from 50 seers of grains will be sufficient for 6 to 10 bighas of land. When the seedlings have grown about 2 inches, the nursery ground requires to be watered at intervals of a week. For *kalpina boro* the plants in the nursery are allowed to grow from 10 to 15 inches before they can be transplanted, for in this case the transplantation takes place on lands containing much water. Smaller plants would do for *chata boro*.

Transplantation — As in case of *amun* paddy.

After treatment. — After the field has been transplanted, it is alternately irrigated and dried till the harvest time comes.

Variety.	Time of sowing seeds in the nursery	Time of transplantation.	Time of harvesting
(1) Winter ...	... Aswin and Kartick ...	Agrahayan ...	... Chaitra, Baisakh ...
(2) Rain ...	... Jaistya ...	... Ashar and Sravan ...	Bhadra and Aswin.

Yield. — The outturn is 7 to 8 maunds of grain. The winter variety gives a better outturn.

2.—*Sugarcane.*

Sugarcane is extensively cultivated throughout the division. Reference has already been made to the fact that the red clay of the western part of the division is rich in phosphorous and very well suited to cane-growing. On account of the necessity of irrigating the fields at a time when water is very scarce, the cultivation of this important crop can only be undertaken in particular localities. Of late the area under cane has somewhat decreased

from a variety of causes, the most important of which are (1) the extension of the cultivation of potatoes, (2) the great damage done to cane by floods, various diseases, wild animals, and insects, especially by white-ants, and (3) the uncertainty of the water-supply during the last few years, the distribution of rainfall having been very irregular.

Varieties.

The different varieties of sugarcane under general cultivation are (1) the *samshara*, (2) *kajali*, (3) *Puri*, and (4) the *Bombay*. Near Burrakar a variety of sugarcane is grown which requires scarcely any irrigation. It is known by the name of *khari*, and is a very inferior cane, small sized, extremely hard, and deficient in juice. The Bombay is a large sized red cane of very superior quality. The rind is soft, the inter-nodes large, and the juice is abundant and rich in sugar. But it is a very delicate cane, specially liable to disease. Ten or twelve years ago hundreds of fields of Bombay cane were totally destroyed by a disease to which the cultivators gave the name of *dhasa*, or rot, which reduces the plants to a rotten mass emitting a most disagreeable odour. Being a soft cane, the damage which wild pigs and jackals do to it is very great. It does not stand the effects of flood and excessive rainfall. This variety of cane has, for these reasons, almost gone out of cultivation, and only a few plants are now met with intermixed with other varieties of cane. Of the difierent varieties now under cultivation, the *samshara* occupies the most prominent place. It grows to a large size, the rind is fairly soft, and the juice is good, both as regards the quantity and quality. It stands stagnant water fairly well. It has a pale yellowish-white colour. This is the variety most extensively cultivated in the Burdwan and the Hooghly districts. The *kajali* and *Puri* are the canes most cultivated in the Beerbhoom, Bankoora, and the Midnapore districts. These are small-sized canes, much inferior to the *samshara*, but extremely hardy.

Soil.

Sugarcane may be grown alike in the clay and the red sand of the division, but preference is given to a mixture of the two. It grows luxuriantly in the dearah lands if these be above the inundation level, but on such soils the juice is somewhat watery and deficient in sugar.

Rotation.

Indian cultivators do not follow rigidly any system of rotation in this any more than in case of any other crop. Cane is regarded as a very exhausting crop, and it is not planted on the same field more frequently than every fourth year. It may come after any of the following crops, viz. (1) one of the pulses, (2) potatoes, (3) *aus* paddy (4) wheat or barley, and (5) mustard, and is always followed by *aus* paddy. Sugarcane does not do well after wheat or barley, and the only variety of cane so grown is *kajali*.

Preparation of the field.

When sugarcane follows potatoes, the land is almost ready for the reception of the cuttings without any further preparation. Two or three ploughings and harrowings are all that is necessary. In other cases the land is repeatedly ploughed and well exposed to sun and air. The first ploughing should better be given in Kartick.* Deep cultivation being a necessity in case of sugarcane, after the land has received a ploughing or two, it is hoed by the *kodali*. This is an expensive operation, but is more than repaid by the increased outturn. From Kartick to the time of planting, the land should be ploughed as often as opportunity offers. If no hoeing be given, it will require no less than 10 or 12 ploughings. With one hoeing about half as many ploughings will suffice. When the ploughings are going on, the fields are manured with cowdung, and the sweepings of the cow-shed. When sugarcane follows mustard or pulses, these latter crops are grown as catch crops. The ryots go on with the preparation of the land as usual, only the ploughings are stopped for some time, and the cowdung is not applied till the mustard and the pulses have been gathered, and the first ploughing has been given. After the soil has been well exposed to sun, air, and rain, and thoroughly pulverised to a depth of not less than 9 inches, the land is levelled as perfectly as possible by passing the ladder several times over the field, when it is ready for the reception of the cuttings.

* 15th October to 15th November.

The planting time extends from the beginning of Pous† to the end of Baisakh,‡ but it is in the month of Falgun§ that most fields are planted. A late planted cane field does not do well, but for want of timely rains the ryots in some places postpone the planting till the first shower of rains in Baisakh. A late planted cane gives only a partial crop, but when the cane is planted in time, and there is not sufficient water to irrigate the field afterwards, the crop is almost totally lost. It is therefore simply a selection of the lesser of the two evils.

† 15th December.
‡ 15th May.
§ 15th February to 15th March.

Planting.

Sugarcane is propagated by cuttings, and for this the ryots of Bengal almost invariably use about a foot of the stem from the top end. They are opposed to using the lower portions of the stem, not only because that would be expensive, but because the buds at this portion are seldom in proper condition to give strong healthy plants. When the cane is pressed for juice, the tops are set aside for planting purposes. With regard to the use of these tops, three different cases may occur: 1*st*, the tops are stripped of the leaves, cut into pieces 6 to 8 inches long, and the cuttings are immediately planted; or, 2*nd*, when the cultivators can afford to wait, these cuttings undergo some preliminary preparation before being used. A hole is made some 3 feet deep where water is close at hand. The cane cuttings are rubbed with pond mud and a little oil-cake, and placed in the hole, which is then covered with straw or cane leaves. Water is daily applied to the cuttings to keep them slightly wet; when the buds have somewhat enlarged, the cuttings are ready for use; or thirdly the cane fields not being yet ready for plantings the tops have sometimes to be kept a long time before they are needed. When this is the case, a hole is dug close to a pond and the bottom of the hole it made into mud into which the cane tops are driven almost in a compac, mass for about two or three inches. Water is now and then applied to keep the tops cool. In this way the cane tops may be kept uninjured for a long time. When needed for planting they are taken out, the leaves are removed and cut into convenient lengths.

A good method of preparing the cuttings is to keep them for about a week in moist sand.

When planting the cuttings, the beds are so arranged as to serve a double purpose, namely, to give facility for irrigation and to remove the rain water from the field as speedily as possible. This is done first by dividing the field into a number of long strips by broad trenches, which will be referred to as main water channels, drawn from the top to the bottom of the field at intervals of some 40 feet. A number of smaller water channels are now drawn across the field, all parallel to one another, and about 7½ feet apart. The whole field is this way divided into a number of small beds each 40 feet by 7½ feet. The water channels are all made by the *kodali*. Now taking a good plough and a pair of steady bullocks, parallel furrows are drawn across these beds at intervals of about 22 inches. Finely-powdered oil-cake is then spread on the bottom of these furrows at the rate of about 4 maunds per bigha. When all this has been done, water is poured from a *ghara* into these furrows, and in the mud thus made cane cuttings, called ticklees, are placed lengthwise, leaving an empty space of about 9 inches between each. The cuttings are then covered with a little earth. In planting the cuttings care should be taken to have the buds placed laterally. The cuttings should not be put deeper than is necessary for the shoots will thus be prevented from coming out, but at the same time sufficient earth should be placed over them to save them from the scorching effect of the sun. A layer of earth about 3 inches thick is about the right quantity. This is the system generally followed.

The mode of planting canes described above is not followed throughout the division. In some places, after the water channels have been made, holes are dug in parallel lines at intervals of about 24 inches and at a distance of 18 inches from one another in the line. Cuttings are put in these holes, one in each, with a little oil-cake and water, and covered with earth. This is the system followed on the southern bank of the Damoodar, the best cane-producing tract in Western Bengal, and differs very little from the Mauritius system. Near Hooghly, where canes are planted rather earlier than elsewhere,

the water channels are not made at the time of planting the cuttings. When the planting is finished, the soil on both sides of the furrows are raised by the *kodali* and placed along the lines in which the canes have been put, so that the field seems to be laid in ridges. The soil there is very light, and unless this plan is adopted the cuttings are soon burnt up. The mode of planting sugarcane known as the Mauritius system, which has been strongly recommended by Messrs. Mylne and Thomson of Beheea, is not unknown in Bengal. It differs little from that practised near the Damoodar, and is exactly the same as that followed by the market gardeners in the neighbourhood of Dacca and Calcutta.

After-treatment.

After the canes have been planted, unless the ground be kept sufficiently moist by occasional rain, the fields have to be watered every 4th or 5th day. This is generally done by pouring water from a *ghara* along the lines in which the cuttings have been placed. The shoots begin to make their appearance in about a fortnight, the time depending on the more or less forward state of the buds at the time of planting and the amount of moisture in the field. When most of the shoots have come out, the field is irrigated by flushing it with water, and in two or three days it will be in a fit condition for hoeing. The space between the furrows is hoed with a *kodali*, and then by holding the edge of the *kodali* parallel to the lines in which the cuttings have been placed, the crust formed is carefully broken up and part of the earth from over them is removed. Some of the cuttings which failed to put forth shoots before will do so now. Places which show no signs of shoots coming up, a week after the hoeing has been given, have to be planted anew.

In a fortnight a second irrigation will probably be needed. In fact, till the rains set in, it will be necessary to irrigate the fields twice a month if not oftener, and after each irrigation the space between the furrows should be once hoed. The plan followed with regard to cane fields of watering the soil and of stirring and exposing it to sun and air repeatedly, probably helps the growth of the plant quite as much as the manures so liberally used.

When the shoots have all come out the operation of earthing up the plants begins, and the furrows along which the canes were planted are converted into ridges (Plan No. 1). But care should be taken not to earth up the plants too soon, for as soon as this is done they cease to tiller. All through the rainy season special attention should be paid to keep all the water channels perfectly cleared, so that rain water may be removed as quickly as possible. Stagnant water is most injurious to cane fields. And after each shower of rains, as soon as the field is in a proper condition, a hoeing, should be given, so as to keep the soil loose and to destroy the weeds, which have a very vigorous growth at this time of the year. After the second week of Bhadra, and till Kartick, it is necessary to hoe only once a month. The operation of tying up a number of plants with the mature leaves begins in Sravan and continues till Aswin. This is done twice a month. When this operation is first undertaken the dead leaves are stripped off. The covering of the stem with leaves is an important operation serving a variety of purposes, and should not be neglected. It affords support against the action of high winds, protects the plants from ravages of jackals, and increases the space between the plants so as to promote ventilation. Some are of opinion that this operation tends also to increase the amount of sugar, but whether this is a fact can only be ascertained by experiment.

At the end of Sravan or beginning of Bhadra, about four or five maunds of oil-cake are applied per bigha as a top-dressing. Sometimes oil-cake is applied thrice—once at the time of planting, a second time in Sravan, and finally in the beginning of Aswin. Sometimes it becomes necessary to irrigate the field once or twice in Aghan.

Manures.

Sugarcane fields are very heavily manured. The manures generally used are cowdung at the rate of 30 maunds and oil-cake about 10 maunds per bigha. In Beerbhoom pig's dung is regarded as the best manure for cane, and pig's dung, we know, is particularly rich in phosphorous. The ashes of *begass* are thrown into the dung heap, and are not separately used for sugarcane alone. In some of the newly-formed dearah lands the amount of manure used is extremely small.

Diseases, &c.

Much injury is sometimes done by white ants to canes just after planting. Another insect known as *majera*, a small grub with black mouth and very sharp teeth, eats the crown of the bud just below the mid-leaf stalk, which soon withers away. When the plants have just sent forth shoots above ground, they are in some places likewise eaten off by hares. At this stage also plants sometimes die for want of water, and while still very young they sometimes suffer from rust.

At a more advanced stage of its growth much injury is often done to sugarcane by wild pigs and jackals. An insect named the *cane borer* bores through the stem and passes a stage of its life within it. As stated before, the variety of cane known as the Bombay is sometimes totally destroyed by a disease named by the ryots the *dhasa* or the rot. The disease seems to be due to fermentation induced by some microscopic vegetable growth within the plant.

Ratooning.

When the canes are cut away, the stool or the underground stem is allowed in some places to send forth fresh shoots, and a second crop is thus obtained. In the Bankura district the second crop gives a better outturn than the first, and there sometimes a third crop is also taken. Ratooning, however, is not popular with the ryots of the Burdwan district. According to them cane is such an exhausting crop that it ought not to be allowed to remain in the same field for more than one year at a time. But the process has one great advantage. Ratooning gives the earliest crop of cane, and this is a consideration deserving of particular attention near large cities. To obtain a good and early crop of cane by ratooning, as soon as the previous crop has been harvested, which should be done early, the field should be watered liberally, manured, and hoed.

Harvest.

The harvesting season is supposed to begin on the last day of Pous, on the occasion of the Hindu festival of *Pous Sankranti*, but as a fact the harvesting is generally delayed till a month later, and is not quite over till the month of Chaitra.

The harvesting of cane is a complex operation, consisting of three parts, namely—(1) the cutting of the canes, (2) the extraction of the juice, and (3) the boiling of the latter into *gur*. To avoid fermentation of the canes or the expressed juice, and the consequent loss of sugar, these three steps must follow one another as quickly as possible. The canes are generally cut by *kodalies* close to the ground. They are then stripped of the leaves and the tops are cut off. For the extraction of the juice three different forms of country mill are in use in the Burdwan Division:—

(1) The first, called *charki*, consists of two horizontal wooden rollers furnished with screws fitting into each other. This machine is worked by two men, sitting at either end, who turn the spokes attached to one of the ends of each of the rollers. A third man feeds it with canes, and a fourth man sitting opposite to him receives the half-crushed canes and gives them back to the third man. The canes must be passed and repassed several times, and even when this is done a large percentage of the juice escapes extraction.

(2) The second consists of two stout wooden rollers placed vertically with a lever attached as in the Behea mill, and is worked by a pair of bullocks. Three men are required to work this mill—one to drive the bullocks, another to feed the mill with cane, and a third to assist him, as in case of (1). This mill seems to be copied from a Bombay pattern.

(3) The third form is the *kalu* or *ghani*, and acts on the principle of a mortar and pestle, but instead of the up-and-down motion of an ordinary pestle in the *kalu*, the pestle is rolled against the sides of the mortar by a lever attached to it.

All these forms of wooden mill are now being slowly superseded by the Behea sugarcane mills. But the prices at which these useful implements are sold are so high that it is quite beyond the means of the generality of the ryots of this division to buy them. They are generally purchased by mahajans, who let them out at so much a day, sometimes at as high a rate as Rs. 2.

The number of men required to make *gur* by the country mill, and the arrangements necessary for the operations, are described below:—

(*a*) Two men are required to cut canes, to remove the tops and leaves, and to carry the canes to where the mill is working.

(*b*) Four men to work the *charki* a whole day, two men working at a time.
(*c*) One man to feed the mill with canes.
(*d*) One man to receive the canes and give them to the feeder to pass them again through the mill.
(*e*) Two men to attend to juice boiling.
(*f*) One man attends to the furnace.

About 3 or 4 maunds of *gur* may be made in this way daily.

The boiling of the juice into *gur* as conducted in most parts of the division is a cumbrous operation, and compares very unfavourably with the practice fowolled in the Shahabad district. Both in making the *gur* and refining it into sugar the Shahabad ryots are far ahead of the cultivators of the Burdwan Division. Iron pans are generally used only in the Beerbhoom district, and there the pans are made on a wrong principle, the edge of the pan being turned up and placed at right angles to the bottom. When earthen pans, or rather pots, are used, as is generally the case in the Burdwan and Hooghly districts, a huge furnance is required. A plot of ground is selected as close to the field as possible, and in this a hole is dug out about 10 feet long, 4 feet broad, and 5 feet deep. Over this is placed a wooden or bamboo frame-work lined with earth for the reception of two series of pots. The hole is open at both ends, through one of which the furnace is fed with fuel, and through the other the ashes are removed from time to time. The fuel used consists of cane leaves and dried *begas* or canes stalks from which juice has been extracted. The number of pots used is generally 12. The juice as it begins to thicken is brought from one pot to another till it finds its way to the last two pots nearest to the furnace mouth. In these two pots, or in some places in one of them, the juice is allowed to attain the consistency of treacle, when it is removed to large earthen vessels capable of holding from two to three maunds of *gur* each.

Lime water is sometimes used to neutralise the acidity of the juice caused by the canes being in bad condition or by the extraction of the juice or its boiling being delayed. Milk diluted with water is added to the boiling juice to assist coagulation, and to bring to the surface the scum, which is carefully removed.

Sugar refining is not an important industry in this division, the *gur* being sold and consumed mostly in the raw state. An inferior kind of sugar known as *dolo*, so called from being moist and cloddy, is sometimes made. When the *gur* in the earthen pots in which it is kept has become granular and has separated from a portion of the uncrystallizable sugar, it is put in gunny bags, which are pressed laterally by means of bamboo slips tied together. These bags are placed on earthen vessels called *gumlas*. After the greater part of the molasses has thus been got rid of, the *gur* is removed to baskets placed over *gumlas* and covered with a water weed called *ganj* (*Vallesneria spiralis*). This weed has an astonishing purifying quality. The molasses pass through the mesh of the basket, and a layer of the *gur* at the top is bleached into a yellowish white sugar, which is removed every alternate day and the weed changed. The bleached sugar is dried in the sun and trodden under foot, when it becomes the *dolo* of the market.

Cost of Cultivation.

	Rs.	A.	P.
Hoeing, 8 men	2	0	0
Ploughing, 8 times	3	0	0
40 bags of dung	2	8	0
To apply the same	1	8	0
To make the water channels, 4 men	1	0	0
To make the furrows, 1 plough	0	6	0
2½ kahans of sugarcane tops	10	0	0
Planting, 8 men	2	0	0
Watering twice, 4 men each time	2	0	0
Irrigation, 2 men	0	8	0
1st hoeing, 5 men	1	4	0

		Rs.	A.	P.
Irrigation, 2 men		0	8	0
2nd hoeing, 4 men		1	0	0
Baisakh	Irrigation, 2 men	0	8	0
	Hoeing, 4 men	1	0	0
	Irrigation, 2 men	0	8	0
	Hoeing, 4 men	1	0	0
Jaistya—Hoeing, 4 men		1	0	0
Ashar—Hoeing, twice		2	0	0
Sravan	2 Hoeings	2	0	0
	4 maunds of oil-cake	4	8	0
	Trimming the leaves, 4 men	1	0	0
Bhadra	Hoeing once	1	0	0
	Trimming the leaves	2	0	0
Aswin	Hoeing once	1	0	0
	Trimming leaves	1	0	0
Kartick—Hoeing once		1	0	0
Agrahayan	Irrigation	0	8	0
	Hoeing	1	0	0
4 maunds of oil-cake at the time of planting ...		4	8	0
		53	2	0

		Rs.	A.	P.		Rs.	A.	P.
Gur making ...	5 men to cut and strip canes ...	1	4	0	per day.			
	1 man attends to the furnace ...	0	4	0				
	1 man boils the juice ...	0	4	0				
	1 feeds the mill ...	0	4	0				
	1 man drives the bullock	0	4	0				
	4 bullocks to drive the mill ...	1	0	0				
	The work is extended over 4 days ...					13	0	0
	Fuel					0	8	0
	Hire of the mill and a pan					4	0	0
	Rent					4	0	0
	Total ...					74	10	0

Outturn	24 maunds of *gur*	96	0	0
	Sugarcane tops	18	0	0
	Total ...	114	0	0

In the preceding remarks I have described the existing methods of cultivation, the cost and the outturn; in part III, section 2, will be found the suggestions which I have to offer for improvement on the present practices.

3.—Wheat.

Wheat is not an important crop in the Burdwan Division. Its cultivation is mostly confined to dearah lands. A red variety is sometimes grown on stiff clay in some places on the higher courses of the Darakeswar and Ajay.

There are three varieties under cultivation, viz:—

Varieties.

(1) Doodhia ... White and plump grain.
(2) Jamali ... White grain, with a red tinge and plump.
(3) Deshi ... Grain small and red.

The cultivation of wheat is very simple. The field is prepared by four or five ploughings and by passing the ladder over it two or three times. The seeds are sown broadcast, and covered in by a ploughing or two and by passing the ladder once. The best mode of sowing is that known among the ryots as *teali*, *i.e.*, finishing the operation on the third day:—

First day ...	Broadcast the seeds. Plough. Ladder.
Second day ...	Nothing is done.
Third day ...	Plough. Ladder.

Wheat fields are not manured in Burdwan, and no after-treatment is necessary.

Wheat is in some parts of the Bankura and the Burdwan districts sown in a very peculiar way. In fields sown with mustard, holes are made at distances of about 36 inches. A little dung and a few wheat seeds are put in each of the holes which are then lightly covered with earth, the wheat and mustard being allowed to grow in the same field.

Wheat is sown alone as well as mixed with mustard or gram. Sometimes linseed and wheat are sown together.

Time of sowing	Kartick.
Quantity of seeds sown per bigha	7 to 10 seers when sown alone. 3 to 5 seers when sown with other crops.
Time of harvesting	Chaitra.
Yield	2 to 5 maunds per bigha when sown alone.

Suggestions for the extension and improvement in the cultivation of this cereal will be found in part III, section 4.

4.—Barley.

This crop is more extensively grown in the Burdwan Division than wheat, the light soils of the dearah lands being well suited to it.

The cultivation is very much the same as that of wheat. It is generally sown in the same fields with *mashuri*, gram, *rambha* or *khesari*.

Yield ... 2 to 5 maunds per bigha.

5.—Maize.

Maize has not yet become a regular farm crop of this division. Small plots planted with maize are to be found near homesteads in many villages, but as a field crop maize is grown, as a rule, only by up-country men, consisting of railway employés and others, who have settled in the Burdwan Division, especially in the western part of it.

Soil.

Maize gives an excellent crop on the coarse-grained red sand so common in many parts of the division. It may be grown almost on any soil excepting very strong clay, but the ground must be high and well-drained. Stagnant water is very injurious to it.

Tillage.

The land receives two ploughings in Falgun, and is then left exposed to sun and air till the rains set in. In Jaistya the first shower of rain is taken advantage of to give the field two more ploughings. The soil is at the same time pulverised by passing the ladder over it after each ploughing. The seeds are sown after the next ensueing rainy day. There are two different systems of sowing.

(1.)—The seeds are sown broadcast over the field and ploughed in.
(2.)—The seeds are dropped in the open furrow and covered by the next furrow.

When the plants are about a foot high, the field is lightly ploughed with the langla or the smaller plough. This greatly encourages the growth of the plants, and makes them tiller better. About a month after the field is a second time ploughed to earth up the plants. When the seeds are sown broadcast instead of ploughing the field twice, as stated above, two hoeings are given with the *kodali*. Maize fields should be weeded once, while the plants are still very young.

Manure.

The only manure used for maize is cowdung, which is applied at the rate of some 20 bags per bigha.

Time of sowing	Jaista.
Harvest time	Bhadra, Aswin.
Quantity of seeds sown per bigha	1 to 2 seers.

II.—Cyperaceæ.

1. *Madur kathi.*

This is the plant from which the finer varieties of Calcutta mats are made.

A wild variety of this plant is common in ditches, borders of lakes, &c., in the south-eastern part of the division, but the culms of this variety are

coarse and cannot be used in the preparation of first-class madurs (mats). It is not a general farm crop of the division, but is grown in limited quantities. in particular localities. It is a crop which well repays liberal treatment.

Soil.

It requires high well-drained land and a loamy soil. It is a rain crop, but stagnant water is very injurious to it.

Tillage.

The land is ploughed as early as possible, and five or six ploughings are given at intervals of about a fortnight. The soil is then turned over deeply by the *kodali*, and is well weathered. The weeds should be thoroughly eradicated; the best way to do this being to gather them as much as possible by the ladder and the harrow, and then what remains by hand picking. The weeds should be dried and burned, and the ashes spread over the field. The clods should be thoroughly pulverised.

Manures.

Two manures are generally applied to *madur kathi* fields, viz. well-rotten dung and pond mud. The pond mud is applied after the land has been hoed by the *kodali*. The dung may be used at any time when the field is being ploughed, the earlier the better. The quantities should be pretty heavy, say about 30 maunds per bigha.

Planting.

After the ground has been deeply stirred, the weeds completely rooted out, and the soil thoroughly pulverized, the ladder should be passed over the field several times, so as to level it well. *Madur kathi* is propagated by roots or more accurately root stalks taken from old fields. About two cart loads of roots are required for planting one bigha. The planting is done by the hand. The roots are placed at regular intervals and covered by earth. The planting is finished by passing the ladder once over the field, and is generally done in Baisakh.

After-treatment.

Being a rain crop, *madur kathi* requires no irrigation. A few hoeings are needed, especially if crusts are formed when the soil dries up after rains. The field should be kept free of weeds, but weeding is required only when the ground has not been properly prepared before planting.

Harvest.

The harvest time is Kartick and Agrahayan. The *culms* after being cut are split into four pieces, which in drying contract so much as to bring the margins in contact or to overlap each other. The split and dried *culms* are made into bundles and sold to the mat-makers.

III.—LILIACEÆ.

1.—*Onions.*

Varieties.

Three different varieties of onions are under cultivation, viz.—(1) the *chota piyaj* or the small onions, (2) the *bara piyaj* or the large onions, and (3) the *Patna onions*. The latter has only lately been introduced, and its cultivation is at present confined to a few villages in the Hooghly district.

Soil.

For the small onions a sandy loam is best; the second variety prefers a somewhat clayey soil. Small onions may be grown even in soils containing an excess of common salt.

(1).—*The chota piyaj.*

Tillage.

This variety follows *aus* paddy, and as soon as the latter has been harvested, ploughings should begin. It is necessary that the soil should be well dried and thoroughly pulverised. Onions send their roots deep into the soil, and deep cultivation is therefore a necessity for them, and is effected either by ploughing the field repeatedly or after, one or two ploughings by giving a deep hoeing with the spade. The soil, in fact, is prepared very much in the same way as that intended for potatoes.

Planting.

After the land has been well prepared, it should be levelled with the ladder and divided into a number of long strips by water channels drawn up and down and 15 feet apart (Plan No. 2). These strips are then divided in the middle by long ridges.

Smaller water channels are next drawn at intervals of some 10 feet and at right angles to the main water channels. They are joined with the latter on one side and on the other come to within a few inches of the long ridges mentioned above. Now, taking a good plough and a pair of steady bullocks, ridges are drawn parallel to the main water channels at intervals of about 18 inches. The bulbs are planted on these as well as on the long ridges at intervals of nine inches.

Manures.

When preparing the field well-rotten dung is ploughed in at the rate of 20 maunds per bigha. When the plants are in a vigorous condition, they are top-dressed with oil-cake finely powdered at the rate of two to three maunds per bigha.

After-treatment.

The plants begin to push over ground in 10 to 15 days. When the bulbs begin to form, *i.e.*, after a little more than a month from the time of planting, the field should be irrigated once. Then a top-dressing of two to three maunds of oil-cake should be given, and the field should be hoed with the *pashuni*. About a month later a second irrigation and a hoeing are given. This brings the cultivation to an end.

Harvest.

When the over-ground portions of the plants have become quite dry, the bulbs are dug out with the *kodali*. The harvest time is Falgun.

Cost of cultivation.

	Rs.	A.	P.
Ten ploughings, at six annas each	3	12	0
Four men to make the water channels, &c.	1	0	0
Four men to plant the bulbs	1	0	0
Irrigation, twice, two men each time	1	0	0
Two hoeings, four men, each time	2	0	0
Oilcake, 3 maunds	3	9	0
Seeds, 1½ maunds of bulbs	2	4	0
Digging out the bulbs, 8 men	2	0	0
Rent	1	8	0
Total ...	18	1	0

Yield varies from 25 to 40 maunds valued at 12 annas a maund; therefore worth Rs. 18-3-0 to Rs. 30.

(2).—*The bara piyaj.*

This variety of onions is grown in two different ways at two different periods of the year :—

(1). Small bulbs are planted in Aswin. Very vigorous plants are given, which are sold more for the leaves and shoots than for the bulbs. Onions thus planted are called *shara* onions. If plants are allowed to remain longer, flower buds make their appearance, which will form seeds at the expense of the bulbs.

The mode of cultivation is like that of small onions.

(2). But the regular cultivation of this variety of onions takes place at a later period.

Rotation.

It is generally grown in fields previously occupied by *aus* paddy or the *niali* and *kele* paddy, sometimes it follows potatoes, *kalai*, or early peas. It is one of the very few crops that may be grown on *amun* lands, favourably situated, *i.e.*, if they be comparatively high, and if means of irrigation be available.

Tillage.

This variety of onions prefers a somewhat heavy class of soil and the land needs not be so well prepared for it as for the *chhota piyaj*. When the ploughings are going on, the field receives a heavy dressing of dung.

Nursery.

The seeds are first sown in a nursery, for which a piece of rich sandy loam is chosen. This is turned over with the spade and finely broken. A heavy dose of well-rotten dung is now thoroughly mixed up with the soil, which should also be well-dried in the sun and aerated. As early in the month of Agrahayan as possible the seeds are sown broadcast at the rate of ¼ seer per

kotwah and are covered lightly with the aid of the sickle, and the earth being pressed round them gently by the hand. The ground should then be covered with date leaves in order to keep it cool, and the land should be watered on the third and fourth day, and thence forward every alternate day. The seedlings come out in 10 or 12 days, when the covering should be removed. The ground should afterwards be watered every fourth day. The seedlings are at first very delicate, and particular care should be taken to see that they are not destroyed when watering the ground. The plan generally adopted is this: water is poured in one corner of the bed and allowed gradually to wet the whole of it. The seedlings are fit for transplantation when they are seven to eight inches high. It is better not to transplant them when they are very young and tender.

Planting.

The field is levelled by passing the ladder once or twice over it, and is then divided into a number of small beds by water channels and ridges made with a *kodali*. The beds measure about 8 feet square each (Plan No. 3) Each of the water channels drawn up and down the field serves to water two series of beds, one on each side. It is not advisable to attempt to water more than one bed at a time, for then there will not only be a waste of water, but the field not being quite level throughout, one bed will receive more than is good for the plants, while another has hardly got enough.

The transplantation may be done in two different ways. The general practice is to water the beds one after the other, and in the soft mud thus made the seedlings are planted in the way *amun* paddy is transplanted. The other plan is to put the seedlings in the dusty earth and to water the field afterwards. The latter is the neater, but it is the more expensive method. The planting season extends from the end of Pous to the third week of Magh.

After-treatment.

For a month and a half the field is irrigated once a week, afterwards once a fortnight, or even at longer intervals. After the second watering the beds are hoed with the *pashuni* and weeded. When the plants are in a vigorous condition, about 3 maunds of oil-cake should be sown broadcast per bigha, the field is then watered, and a second hoeing is given. After this the only operation required on onion fields is to water them at intervals. The over-ground portions of the plants begin to die at the end of Baisakh, when the bulbs are dug out with the spade and cleaned:—

Cost of cultivation.

	Rs	A.	P.
Six ploughings, at 6 annas each	2	4	0
Making the beds and planting, 10 men, at 4 annas each ...	2	8	0
Irrigation, 6 times, 2 men each time	3	0	0
2 Hoeings, 4 men each time	2	0	0
3 Maunds of oil-cake	3	9	0
To dig out the bulbs, 8 men	2	0	0
20 Bags of dung	1	4	0
To apply the same	0	8	0
Rent	1	8	0
	18	9	0

Yield from 30 to 60 maunds per bigha, valued at 8 to 10 annas a maund therefore worth Rs. 15 to Rs. 37-8.

3.—*The Patna varitey.*

The cultivation of this variety is exactly like that of the large onions. Like the latter, Patna onions may be propagated either by bulbs or seeds. When bulbs are used, they should be planted at the same time and in the same way as *shara piyaj* described above. The bulbs will soon send forth vigorous flower buds, and unless the crop is intended to supply seeds, these should be very carefully pulled off. It will be necessary to do this three or four times, but as the success of the crop depends on this operation, no pains should be spared to tear off the flower buds as often as they make their appearance. If allowed to grow, these flower buds will remove all the food materials stored up in the bulbs, causing the latter to shrivel.

2. *Garlic.*

Two varieties of garlic are grown; both are of the same colour—white, but one is larger than the other. Both are planted at the same time. The mode of cultivation is exactly like that of small onions, with this exception that instead of one row of onions two rows of garlic are planted on the ridges.

Time of planting	... Kartik
Time of harvesting	... Falgun
Quantity of seeds per bigha	... 15 seers

Yield, 7 to 12 maunds. A maund sells for Re. 1-12 to Rs. 2-4. Young garlic plants with immature bulbs are sometimes sold as *shara piyaj*.

IV.—Aroideae.

1.—*Kachu.*

Four different varieties of this vegetable are grown as field crops in the Burdwan district, viz, (1) the *parhati*, (2) *garalmani*, (3) *jhera*, and (4) *komarbhog*, also known as *bhatkachu*. Of these the last requires a particularly rich loamy soil, and is grown as a second crop intermixed with ginger.

Soil.

Kachu requires a light soil, doing best in sandy loam. It would be useless to try it in clay, for, even if the plants could be made to grow luxuriantly on a stiff soil, the rhizomes would not thrive.

Rotation.

Kachu is grown after one of the pulses or oil-seeds in the same year, and is sometimes grown after potatoes or sugarcane. It is also followed by potatoes or sugarcane.

Tillage.

It requires 6 to 8 ploughings to prepare a *kachu* field. After potatoes, two ploughings suffice. The soil should be deeply stirred and well pulverised.

Planting

When the preparation of the soil is complete, the field is levelled by the ladder, and furrows are drawn up and down the field at intervals of 3 feet. Now, the field is divided into a number of beds about 40 feet by 12 feet by drawing water channels up and down as well as across the field (Plan No. 4). *Kachu* buds are planted in the furrows at intervals of 1 foot. No water is necessary at the time of planting.

After-treatment.

The plants take nearly a month to come out. When they have all come up, the space between the rows is hoed, and the plants are earthed up. Before doing this it may be necessary to water the field. This is generally the case with the early planted fields. When the rhizomes begin to form, the plants should be earthed up once more. All through the rainy season care should be taken not to let water stagnate in *kachu* fields The earliest planted fields will be ready for the harvest by the end of Sravan. It may sometimes be necessary to water the field once or twice in Aswin and Kartik. By the end of the latter month the rhizomes are all dug out excepting those intended for seeds.

Planting time	Falgun to Baisakh.
Harvest time	Sravan to Kartik.

V.—Musaceæ.

1. *Plantain.*

This important plant, giving a nutritious and valuable food, is extensively cultivated throughout the eastern part of the division, more especially along the banks of rivers.

Varieties.

There are many varieties of plantain under cultivation here, all of which may be classed under two heads:—

(1) Those grown for their sweet and fine-flavoured ripe fruit.

(2) Those grown for their raw fruit used as green vegetables. The different varieties of plantain under this head have the general name of *kachkala*.

Of the above two classes, *kachkala* is the only one which may be regarded as a farm crop. Plantain belonging to the other class, and especially the better varieties of it, require to be grown as a garden crop.

Soil.

The kachkala will grow almost in any soil except stiff clay and barren sand. Plantain does best on the newly-raised earth of the embankments of canals and tanks, and the best varieties of class (1 should be grown on such lands only.

Planting.

As a farm crop it is seldom planted alone, for when the cost of cultivation is thereby unnecessarily increased, and sometimes it becomes very difficult to keep the land clean. Ordinarily *kachkala* is planted on the standing *aus* paddy, *kachu*, *begun*, or turmeric; it does best in a *begun* field. Some put in plantains even in *amun* paddy, which is neither profitable nor good for the plantain.

The usual time for planting is the end of the Jaistya and the whole of the month of Ashar. Sravan is too wet for this purpose. Of the shoots that come out from each plant, two small ones are allowed to grow, all the rest being dug out and used for planting, if necessary. Very small trees are not good for this purpose. The small shoots that come out from the root stock of a tree that has been cut away are not good for planting. These shoots are very late in bearing, and the fruits are fewer in number. The trees are planted 12 to 15 feet apart. They are put into the ground to a depth of three-fourths to one cubit. The plants require no watering, as the planting is done in the rainy season.

After-treatment.

When plantain is put in among standing *aus* paddy, after this latter has been harvested, a crop of *kalai* may also be taken off the field. When put in among *kachu* and *begun*, no other crop can be grown in the plantain field after these crops have been gathered. When *kachu*, *kalai*, or *begun*, as the case may be, is off the ground in the months of Baisakh and Jaistya, the field is ploughed two or three times. The trees begin to bear fruit one year after the time of planting, *i.e.*, from the beginning of Ashar. Henceforth plantains alone should occupy the ground. When new plants begin to make their appearance, as stated before, only two are kept and the rest are removed. During the rainy season the weeds should be destroyed by turning the soil over with the *kodali*. In the month of Aswin or Kartik the land should either be hoed once or given two or three ploughings.

If after leaving one large and two small trees in one place all other sprouts be regularly removed, a plantain field may be kept up for more than ten years.

Disease.

The great enemy to the plantain is a large black insect resembling that so common in cowdung. It is known as the *antopoka*, or insect of the plantain rootstock. It takes up its abode at the crown of the root-stock just below the midleaf, and the leaf stalks soon begin to wither and the tree dies. There is no remedy for this pest known to the ryots. All the trees in the clump of which one has been thus attacked should be uprooted and taken away from the field, and new trees ought to be planted in their place.

The earthworm also sometimes does injury to the plantain.

Plantain trees are also liable to be broken down and their leaves torn into pieces by storms.

Cost of cultivation.

	Rs.	A.	P.
To plant, two men, at four annas each	0	8	0
One hundred trees	2	8	0
Ploughing, three times	1	2	0
Hoeing once, eight men	2	0	0
To remove the superfluous trees, five men	1	4	0
Hoeing, five men	1	4	0
Ploughing, three times	1	2	0
Rent	3	0	0
Total ...	12	12	0

VI.—"ZINGIBERACEÆ."

1. *Ginger—Ada.*

Varieties.

There is only one variety under cultivation, which being grown under nearly the same conditions everywhere, and being propagated by buds and not by seeds, has not undergone much variation.

Soil.

The only soil on which ginger can be profitably grown is a fine sandy loam, both light coarse sand, and stiff clay being quite unsuited to this crop. It is necessary that the soil for ginger should be loose. Sandy soil is loose when dry, but during the rains and after irrigation it sinks and becomes compact.

Rotation.

Ginger does best after potatoes and *kachu*, but can also be grown after any of the pulses. The general principle on which the rotation of ginger is regulated is this:—It can be grown either after a crop which requires no irrigation, or after an irrigated crop if in the cultivation of this latter the ground had to be hoed constantly. In both cases the land is kept loose and mellow.

Tillage.

The ploughing begins in Chaitra. After each fall of rain the land should be ploughed once. The soil should be thoroughly pulverised and stirred to as great a depth as possible. It should also get well weathered. The land altogether receives from 12 to 14 ploughings. The planting season is in the last week of Baisakh and the first week of Jaistya.

Planting.

When the field is ready for planting, it is levelled with the ladder, a number of main-water channels are drawn up and down the field from 60 to 80 feet apart (Plan No. 5). Then a number of smaller water channels are drawn at right angles to the preceding ones and about 8 feet from one another. Pieces of ginger about three inches long are now planted in lines parallel to one another, and extending from one of the smaller water channels to the next one. Earth is then raised by a *kodali* from two sides of these rows and put over the pieces of ginger to a depth of nearly 9 inches. The field now appears to be laid in ridges, the furrows between which are closed at the upper end and opened into the smaller water channels at the lower end. At *m*, *m*, &c., are planted chillies; at *b*, *b*, &c., *beguns*; and at *k*, *k*, &c., *kachus*. The ginger pieces are placed at intervals of 9 inches in the rows, which latter are 18 inches apart.

After-cultivation.

The plants may come out in 10 to 15 days, but may take as much as two months. Throughout the rainy-season every possible care is taken not to let water accumulate in the field, stagnant water being most injurious to ginger. As soon as weeds make their appearance, they should be pulled out with the *phor*. If on account of frequent heavy showers the earth sinks and the soil ceases to be friable, the field should be hoed with the *pashuni* or hoe. At the end of Bhadra the plants are top-dressed with four maunds of oil-cake, consisting of two maunds of mustard and two of castor cakes, and then earthed up. If the field be dry, irrigation is needed in Kartik. If there be no rain in the cold weather, irrigation is required twice a month till Falgun, when the ginger is to be lifted.

Four maunds of ginger are planted in one bigha, and the yield is from 40 to 60 maunds.

Manures.

At the time of ploughing the field in Chaitra, about 30 maunds of well-rotten dung is applied per bigha and then, as stated before, the plants are top-dressed with four maunds of oil-cake.

Sometimes in the month of Assin the ginger cuttings which were planted are carefully removed by the *phor*, without disturbing the rest of the plant, and sold at a high price. For this it is necessary that the cultivators should know the exact spots where the cuttings were placed at the time of planting. Out of the four maunds of seeds nearly three maunds of ginger may be recovered in this way.

Cost of cultivation.

	Rs.	A	P.
14 ploughings, at 6 annas each	5	4	0
Price of 4 maunds of ginger, at Rs. 4	16	0	0
To make the water channels and plant, 8 men, at 4 annas each	2	0	0
Weeding 3 times, 7 men at a time, at 4 annas each ...	5	4	0
To stir up the soil, 4 men	1	0	0
To earth up, 6 men	1	8	0
Irrigate 4 times, 2 men at a time	2	0	0
To lift the ginger, 8 men	2	0	0
To remove the roots, 3 men	0	12	0
Dung, 30 maunds	1	14	0
To apply the same, 3 men	0	12	0
4 maunds of oilcake	5	0	0
Rent	3	0	0
Total ...	46	6	0

Yield 40 to 60 maunds sold at about per maund.

2. *Turmeric—Haldi.*

Varieties.

Two varieties are grown—one known as the *deshi* or country, and the other as Patna variety. The latter is of a richer colour and gives a better outturn.

Soil.

Loamy soil, even of very inferior quality, will grow turmeric. It can be grown in shady places, but does better on open grounds.

Rotation.

Turmeric is grown after one of the pulses.

Tillage.

The preparation of the soil necessary for turmeric is similar to that for ginger, but lands intended for turmeric need not be worked so fine. Six or seven ploughings suffice for this latter crop.

Planting.

The mode of planting turmeric very much resembles that of sugarcane: the only points on which the two differ are the following:—The furrows in the sugarcane field are about 6 feet long and 22 inches apart, those in the turmeric field being twice as large and 27 inches apart. Sugarcane cuttings are very lightly covered with earth; over 6 inches of earth is placed on the turmeric cuttings. The usual planting time is the first week of Jaistya.

After-treatment.

The plants will come out in a fortnight. They should be earthed up twice: once in Ashar and again in Kartik. One or two weedings will be needed. Stagnant water being very injurious to turmeric fields, rain water must not be allowed to accumulate in the field. Irrigation is not necessary.

Harvesting.

The portions of the plants above the ground wither and die in Magh, but in the Burdwan division it is not considered good to lift them the first year At the end of Magh the furrows are cleared by the plough, or better still by the *kodali*. New shoots are sent forth at the setting in of the rains, and the plants are treated exactly as in the first year. After about a year and nine months turmeric is lifted in the beginning of Falgun. When it is raised the first year, as is the practice in some places, the produce is less in quantity and inferior in quality.

After the rhizomes have been dug out of the ground, they are freed from the fibrous roots and cleaned. They are then put in earthen pots, the mouths of which are to be carefully closed with earthen covers and cowdung. These pots are then very gradually heated. The turmeric is made to boil in its own juice a process which gets rid of the raw smell of turmeric. It is then dried in the sun the drying taking nearly a week, during which the turmeric requires to be covered in the night to protect it from dew. In some places turmeric is boiled in water in which a little cowdung is mixed.

Cost of cultivation.

	Rs.	A.	P.
6 Ploughings	2	4	0
3 Maunds of seeds, at Rs. 3 a maund	9	0	0
Planting, 8 men, at 4 annas each	2	0	0
To earth up 4 times, 4 men each time	4	0	0
4 Weedings, 3 men at a time	3	0	0
Repairing the furrows, 4 men	1	0	0
To dig out, 6 men	1	8	0
To clean, 3 men	0	12	0
To boil, 6 men	1	8	0
To dry, 8 men	2	0	0
Earthen pots	1	0	0
Rent	4	0	0
Total ..	32	0	0

VII.—PIPERACEÆ

1.—*Betel—Pan.*

Betel is extensively grown in some parts of the division, especially along the banks of the Hooghly. The following is a description of the mode of cultivation followed in the village of Bantul, in the Uluberia subdivision, which has the reputation of producing the finest betel leaves in Bengal.

Varieties.

Three different varieties of betel are grown here, viz., the *Bangla* or country, the *khas*, generally known by the name of *sanchi pan*, and the *karpurkath* or the sweet. The cultivation of this last variety, which has a very fine flavour and smells like camphor, is very limited. It grows only in few fields, and even in these only few plants out of many planted succeed.

Soil.

Betel grows best in the friable black clay resembling pond mud and containing a large amount of organic matter. It is, however, worthy of notice that the betel gardens at Bantul, which used to grow the most highly flavoured *karpurkath*, consist of a rather light loam, very slightly reddish. Soils of this description are no longer available in the village, and new gardens are mostly made of the ordinary clay of the description mentioned above. The land must be high and well drained, stagnant water being most injurious to betel.

Preparation of garden.

To make a new betel garden, or *boroz*, as it is called by the cultivator, a plot of land situated on high ground well-drained and close to a pond or khal is selected. The soil generally is a blackish clay containing a large percentage of decomposed vegetable matter. Underbushes, if there be any, are cut down, and their roots dug out with the spade. The whole land is then thoroughly turned over by the same implement to a depth of 18 inches. Trenches are dug around the field, and the earth thereby raised is spread over it. In some places, when making a new *boroz*, the whole field is raised by 5 or 6 inches with pond mud, but this is not the practice at Bantul. By the repeated use of the *kodali* the ground is thoroughly stirred to more than a foot and pulverised as fine as possible. The land is levelled and over it a roof is placed made of bamboo slips and jute stalks supported on bamboo posts to a height of $4\frac{3}{4}$ cubits from the ground. The four sides of the *boroz* are enclosed by *tattis* made of the same materials as the roof. Great care is taken in the making of the bamboo supports. Good, sound, and well-ripe bamboos are cut into pieces, each about 10 feet long. These are slit in the middle, dried in the sun, and then kept under water for about a month. The uprights are placed in parallel lines alternately 18 and 27 inches apart. The opposite uprights of lines 18 inches apart are made to intersect one another a little over half the way up. The betel cuttings are planted between the other two lines of uprights at intervals of 6 inches.

Planting.

The cuttings are made from plants taken from old *borozes*. These cuttings are about 12 to 18 inches long, and, contain five or six joints each, of which two are buried in the earth and the portions left over ground are made to recline on the

surface. These are then covered with date leaves, and watered every morning and evening till they strike root and put forth buds. The planting time extends from Jaistya to Kartik. In some places the cuttings are first planted in nurseries, and when they have struck root and sent forth new leaves and buds, they are taken out for transplantation.

After-treatment.

As the plants go on increasing in length, one or two jute stalks are stuck into the ground close to each, the other ends of the stalks reaching the roof. The betel plants are tied to these supports by the straw of *ulu* cut into lengths of one foot each; when the plants reach the roof they are pulled down, and a portion is made to rest on the ground in a coil which is covered with a little earth. This process is repeated as often as necessary, and every time this is done two or three leaves are plucked from below.

Pond mud and other kinds of earth well-dried and pulverised are placed between the lines, and are used as occasion requires in earthing up the plants. In this way the whole ground is slowly raised; and to keep the roof at the proper height from the ground, it has to be changed every second year. Some of the old *borozes* at Bantul have on this way been raised above the level of the first floor of the surrounding buildings.

Manures.

The manures generally used are—(1) cowdung dried and well ground into a fine powder, (2) pond mud dried and powdered, and (3) oil-cake. The mode of applying these manures is to put them round the roots and cover them with a little earth. Mustard cake only is used in *borozes*. Castor cake destroys the plants. Brick-dust is likewise sometimes used.

All through the summer the *borozes* require to be constantly irrigated, but excessive watering is very injurious, and stagnant water should on no account be allowed to accumulate in *borozes*.

Diseases.

Betel is liable to the attack from many diseases, most of which seem to be of a fungoid nature. Some attack the leaves only, others the stalk and whole plant.

1*st*.—Diseases of leaves—

(1) *Tuto*.—Black stains, which increase in size and destroy the entire leaves.
(2) *Bont angāre*.—From which the leaf stalks rot.
(3) *Nonā*.—From which the leaf stalks wither away.
(4) *Tasare*.—From which the edges of leaves turn red.
(5) *Chittigābri*.—From which the edges of leaves rot.

2*nd*.—The disease of plants—

(1) *Angāre*.—The joints of the plant turn black and then rot. It is an infectious disease. Any plant on which water from the affected parts of the diseased plant falls is attacked. The diseased plants are therefore carefully removed and thrown away, together with a portion of the earth on which the plant was growing.

(2) *Gāndi*.—The part of the plant just close to the ground is affected. The plant turns red and dies. *Remedy*—onion juice and cowdung mixed together and sprinkled over the plant do some good.

VIII.—Moreæ.

1. *Mulberry*.

Formerly mulberry was extensively cultivated throughout the division. But the silk industry has of late considerably declined, for causes which I do not here discuss, and mulberry growing is now confined to parts of the Midnapore and the Beerbhoom districts. The following is an account of the mulberry cultivation as carried on in the Ghatal sub-division of the Midnapore district.

Varieties.

Two varieties of mulberry are grown here, viz., *Morus alba* and *Morus indica*.

Soil.

In the opinion of the cultivators mulberry can be grown on any description of high and well-drained land, success depending more on the mode of cultivation and the quantity of manure used than on the nature of the soil. It seems, however, that it does better in clay loam than either in stiff clay or sandy soils.

Preparation of the field.

Deep cultivation is an absolute necessity in the cultivation of mulberry. For this purpose the ordinary country plough is altogether inefficient. As soon as the rains are over and the earth is still soft, the land is dug to a depth of about 18 inches by the *kodali* is generally done in Aswin to Kartik. This depth is attained at the cost of much labour and expense. The large clods are broken by hammering. The field is then ploughed twice and levelled with the ladder. If there be no rain and the ground be dry, it will be necessary to irrigate the field before ploughing; the land should be well weathered.

When the land has been well prepared, holes are made over the field 18 inches apart, each hole being 18 inches by 18 inches and 6 inches deep.

Planting.

Mulberry is propagated by cuttings. When an old field is cut down, the plants are divided into pieces about 9 inches long, the tops as well as very thin and dry stems being rejected. The cutting is done by placing the stalks on a hard substance and striking them with a sharp knife, care being taken at the same time not to split the ends. The cuttings are then made into bundles tied with grass close to the top and bottom. A hole is now made near a tank, and the bottom of it is worked into mud. The bundles are sunk into this mud to a depth of a few inches, and are then covered with more of the same substance. The cuttings are kept in this way for about a month, and are from time to time watered. When the buds have put forth shoots about 2 inches long they are taken out for planting.

In the holes made in the fields, as above described, these cuttings are placed horizontally from one to three in each hole. They are then covered with earth and watered from a *kulsi*. The cuttings are well pressed into the earth, taking particular care not to break the shoots. As long as the cuttings do not take root they should be watered once a week. When the plants become about a cubit high the whole field is flooded, and after a week it is hoed with the *kodali*, the earth that was raised in making the holes being thus spread around the plant.

After the plants have attained to a height of two to three cubits, it is not necessary to irrigate the field more frequently than once in 1½ to 2 months.

Plucking the leaves.

The cuttings are planted in Kartik to Agrahayan. In Falgun the plants will be in a fit condition for plucking the leaves. At first only the leaves should be plucked, but when the plants have grown sufficiently, the twigs can be removed without injury.

After-treatment.

The field should be hoed once in May, and in Ashar weeds should be smothered by turning up the soil. In Chaitra (2nd year), before the commencement of the leaf-plucking season, the field is manured with pond mud, the quantity of mud used being often so large as to alter the whole nature of the soil. About 400 maunds of mud are applied per bigha. The mud receives no previous treatment before being brought to the field, but before being mixed with the soil, it is first placed in heaps between the rows of plants, and exposed to sun and air, and is mixed with the soil at the hoeing time in May.

The fields are thus manured with pond mud once in every three years. The plants are kept up for 10 or 12 years, when they are ratooned, *i.e.* they are cut down at the bottom, when the field is hoed and manured. New plants come up, and these are kept up for five years more, when a new field ought to be made Sometimes a second ratooning is given, and the plants are kept up for another five years.

IX.—Sesameæ.

1. *Til oilseed.*

Varieties.

Two varieties of til grown here, viz., (1) the black, and (2) the white. The latter is also called the *kat til*. The former has a deep black colour. It is generally sown at the end of Kartik. Where indigo is grown this variety of til and indigo are sometimes sown together in the same field. The black til contains less oil, and gives less outturn than the other variety. It has also the additional disadvantage that it must be sown at a time when the other rubbi crops also are to be sown. The white variety is sown at the end of Magh. It is one of the very few crops which can be grown on *amun* lands, for it is sown at a time when the *amun* has already been harvested, and it is gathered early enough to prepare the land for the next *amun* crop.

Rotation.

The black variety comes after the *aus* pady. The white *til* may be grown after *aus* as well as *amun* paddy. It is also sometimes made to follow potatoes, but then the same field bears three crops a year, viz., *aus* paddy, potatoes, and *til*, which puts a heavy drain on the land.

Til is liable to lodge if the soil is very rich.

Tillage.

The black til.—After the *aus* paddy has been harvested, the land should be ploughed and cross-ploughed, and then exposed to sun and air for a few days. Altogether the land is given 4 or 5 ploughings, and by the repeated use of the ladder the soil is thoroughly pulverised.

Sowing.

On the day of sowing, the field is ploughed and is levelled with the ladder. Then 1¼ seers seeds is sown broadcast in two lots: first along the field and then across it. This is necessary to ensure the uniform distribution of the seed. It is also necessary that a calm day without wind should be selected for sowing til. The land is ploughed lightly and harrowed twice.

After-treatment.

The plants will take four or five days to come out. A heavy rain after sowing will spoil the seed; a slight rain does good. When the plants are about 9 inches high, thinning and weeding will be necessary. For a good crop it is very necessary that the plants should not come out too thickly. In very rich land, however, thick sowing will prevent the too luxuriant growth and give a better yield. In the month of Pous it will be necessary to irrigate the field once when the plants begin to flower.

Harvest.

The harvest time extends from the end of Chaitra to the first fortnight of Baisakh. Til is harvested when it is still green. A plot of ground is well cleaned, and on this the plants are put in a heap, covered with palm leaves or straw, and weighed. After four or five days they are spread under the sun, when the seeds are shed without any beating or treading, and it is only necessary to shake the seeds off the plants and remove them.

Outturn.

The yield varies from 3 to 7 maunds per bigha.

The white variety.—The cultivation of this variety is very much the same as that of the black, but the land on which it is grown, being somewhat clayey, requires a greater number of ploughings for its preparation. There is one precaution to be taken with regard to this variety of *til*, viz., rain water should never be allowed to accumulate in the field, as stagnant water is most injurious to it. White *til* is harvested in Joistya. The yield is a little greater than that of black variety.

Diseases.

A black insect known to the ryots as *thikere poka* sometimes does much injury to the young plants, eating away the tender leaves and buds.

X.—Solaneæ.

1.—*Potatoes.*

This valuable crop is largely cultivated in the Hooghly and Burdwan districts, and the cultivation of it is yearly increasing. The spots that have

generally been selected for its cultivation are the old beds of rivers which have either changed their course or have altogether dried up. Most of these places may be connected by a line which, commencing close to Baidyabati station on the East Indian Railway, passes along the Tarakeswar Railway line almost throughout its length; between Haripal and Tarakeswar it changes its direction, and coming close to the important village of Chakdighi in the Burdwan district, passes along the Chakdighi-Memary road; at Memary it crosses the East Indian Railway line and comes to Satgachi; it then changes its direction again, and passing along the Burdwan-Culna road *vid* Bohar, comes to within a few miles of the sub-divisional town of Culna on the Hooghly. The places most famous for potato culture are Nalikul, Haripal and Singhur in the Hooghly and Memary, Satgachia and Bohar in the Burdwan districts.

Soil.

The best potato soil is a sandy loam having as fine a texture as possible. The soil must not be saline, nor must it contain too much of iron. Soils containing *kankar* or nodules of carbonate of lime are also considered by the ryots unsuited for potatoes. As artificial irrigation is indispensable in the cultivation of potatoes, canals, tanks, jhils, or some other form of reservoir for water must be close by. The ryots mostly make use of tanks or small rivers in irrigating potato fields. Irrigation from wells is not resorted to, but the practice of potato-growers in the Patna and the Shahabad districts shows that where labour is cheap and the water is within a reasonable depth, this mode of irrigation can be profitably adopted. All the necessary requirements for the successful cultivation of potatoes are met with near small rivers or their old beds. Sandy soils near large rivers are coarse grained. The south-eastern part of the division along the Hooghly below Howrah, and along the lower courses of the Damudar or Rupnarayan being subjected to strong tidal currents, is not suited to growing good potatoes on account of the soil containing too much common salt. Land along the upper courses of these two rivers, as well as that along the Burrakar, Ajai and the More, is too coarse grained and contains too much of iron. Here and there, however, detached areas are to be met with all over the division where all the conditions requisite for profitable potato culture exist.

Varieties.

The different varieties of potatoes grown here may be classed under two heads. The deshi or country varieties including *usha*, *jhati*, *benajhara*, *goro* and *thikre* and the—the imported varieties known as the Bombay. Of the country varieties the *Benajhara* is the best. The Bombay variety is a middle-sized, thick skinned and mealy potatoe, and is grown to a very limited extent, and its cultivation being almost entirely confined to the villages of Singhur, Haripal and Nalikul. Generally speaking, the seed used by the ryots is very bad, no care being taken either to select good or to introduce new seed.

Seeds.

Generally the smallest potatoes are used for seeds, but the middle-sized tubers are admitted to be better. Three different kinds of seed are used. If a potato plant be raised, it is found that there are small potatoes close to the surface; then there are the large and middle-sized potatoes, and below them again small potatoes. For seed purposes are used the small potatoes close to the surface as well as those found below the large potatoes. Of these two, the former, when partially exposed to light and turned somewhat green, are considered very good for seeds, while those found below the large potatoes are regarded as the worst for this purpose. But the best potato seeds are obtained in the way described below. While the plants are still quite strong and healthy the earth is removed from around the large tubers, which, though somewhat immature, are raised and sold in the early market at a high price. The parts of the plants immediately above the ground are then covered with earth and the fields are watered, so that a second crop of middle-sized potatoes is thus obtained and kept for seed.

Much care is taken by the ryots in the preservation though little or none is taken in the selection of seed. After potatoes have been sorted those kept for seeds are dried in the sun and spread over a bamboo structure (*machan*) in a cool part of the house. The potatoes must not be kept in heaps, but spread as thinly as possible. If sufficient space be available, they should be so kept that one may not touch another

At the setting in of the rains potatoes begin to rot, and then the rotten and diseased ones should be picked off as frequently as possible, for one rotten potato will spoil all with which it comes in contact. Potatoes kept for seeds are sometimes much injured by a disease known as *ladhara*, the lac disease. The first symptom of this disease is the appearance of a white powdery substance like wheat flour around. the buds or the eyes, which when pressed with the fingers become red. The potato so attacked rots, becoming quite watery within. The disease makes its appearance in the months of Ashar, Sravan, and Bhadra, and is very infectious: when it once makes its appearance, all the potatoes in the village, and sometimes even in the neighbouring villages, are sure to be attacked by it. Generally out of 10 maunds of potatoes kept for seed purposes, 7 maunds are ordinarily available for planting at the sowing time, but when the lac disease makes its appearance, it often happens not even a single potato remains.

Rotation.

Potatoes are often in this division grown on the same field year after year. A newly broken field does not give a good outturn. Potatoes are generally grown after *aus* paddy as a second crop, but a field which grows only potatoes gives a better crop, and on such fields potatoes may also be grown much earlier.

Tillage.

Early planted potatoes are likely to bring greater profit to the cultivator, but early sowing is attended with some risks. For the early market potatoes must be put in immediately the rains have ceased, for should there be heavy showers after the potatoes have been planted, whole fields may be totally injured, thus requiring replanting or growing with some other crop. Of the two varieties, the *deshi* and the hill potatoes, it is necessary that the latter be put in earlier, because while by proper irrigation the plants of *deshi* potatoes may be kept up till the end of Falgoon, the hill potatoes will die off by the end of Magh; and if put in late, there will not be sufficient time for the proper growth of the tubers. Potatoes are sometimes put in as early as the end of Bhadra, but the most general time for planting is the end of Aswin. When potatoes follow *aus* paddy, as is generally the case, as soon as the latter has been harvested, the land should be ploughed repeatedly. The object to be kept in view in preparing lands for potatoes is to pulverize the soil thoroughly, and to cultivate as deeply as possible. It is also necessary completely to eradicate the weeds and the roots of the paddy. All this is effected by the repeated use of the plough and the ladder. Clubs are sometimes used in breaking the clods, especially if the land be heavy. The furrows should be made light, but as close as possible, and after every ploughing the ladder should be passed. It is also necessary that after the paddy has been harvested the soil should be at least once thoroughly dried by exposure to sun and air. This is done by not passing the ladder over the field after the first two ploughings, but laying it in open furrows. Sometimes when the paddy is harvested, the land is left too dry to work with the plough: it will then be necessary to water the field before commencing with the ploughing. Where fields are set apart for the cultivation of potatoes after potatoes, without the intervention of any other crop, there is much time to work the land. This is done at Nalikul, the greatest potato-growing village in Bengal. Here potato fields are sometimes enriched by green manuring. At the beginning of Jaistya, indigo seeds are thickly broadcasted in the fields intended for potatoes. At the end of Ashar the plants are ploughed in and mixed with the soil.

Planting.

When the land has been well prepared, it is levelled as perfectly as possible by passing the ladder several times over the field, which is then divided into a number of plots by water channels (plan No. 6). A number of main channels are first drawn from the head land to the bottom of the field, dividing it into a number of long strips about 40 feet broad. Smaller water channels are then made across these strips at a distance of 15 feet from one another. Now by means of a piece of rope and two sticks the spaces between the smaller water channels are marked by a number of lines parallel to the main water channels, and at intervals of 22 inches; lines are also made parallel to the smaller water channels equidistant from two contiguous ones. Finely powdered oil-cake is now spread along these lines, and the soil turned up by the *kodali*. The

kodali must be made to go as deep as possible. Potatoes are then planted by hand along these lines. The seeds must be put in deep enough to save them from the scorching sun. Small entire potatoes of which the shoots have developed to 2 or 3 inches are generally planted in case of the country varieties. Not to break the shoots the earth over them is placed very carefully, but it is at the same time necessary that this should be well pressed to save the tender shoots from the sun. These two conditions are fulfilled by making the earth over each of the seeds into a hemispherical ball. The Bombay potatoes are not planted entire, but are cut into pieces containing one or two buds. In case of the country variety the ryots prefer middle-sized potatoes with only one strong bud. A potato with a number of eyes gives weak plants. The potatoes are planted at a distance of about 7 inches in the rows.

After-treatment.

In case of the *deshi* potatoes the plants will come over ground in a week; the Bombay variety will take a little longer. If the plants do not come out in due time, it will be necessary to apply water, which is done in the following manner. The main and the smaller channels are filled with water, and then by means of a shallow earthen vessel called *shara*, water is thrown into the space between the minor channels, one-half of which is watered by the channel on one side, and the other half by the channel on the other side. If a crust be formed by this watering, it should be broken. The plants now generally come out, but if there be failure in any place, the process should, be repeated. Plants, however, which come out without watering, shooting through the dust as it is called by the ryot, are much stronger. After a few days again apply water in the way described above, hoe the space between the rows of potato plants by a *kodali*, and stir up the soil along the lines of plants. When the plants have grown to a height of about 6 or 7 inches, the operation of earthing up should begin. The field is watered as before, the spaces between the rows are hoed, and the plants slightly earthed up. This first earthing up, called *kani mati*, is done by placing a little earth with a corner of the kodali. After this operation has been done, the field appears as if laid in ridges, and as if the plants had been planted on these ridges.

The next operation is called *sara mati*, or finishing the earthing up. The field is once more irrigated, but henceforward by letting water pass through the furrows between the ridges, the plants are top dressed with powdered oil-cake, and finally earthed up. This finishes all the important operations in potato cultivation ; the only thing that now remains is to irrigate the field once in every 7 to 10 days.

Manures.

The manures applied to potatoes are well rotten dung, mustard and castor cakes and ashes, more fields being manured with castor cake than with any other manure. Dung is used only in a well-rotten state, and that a long time before potatoes are put in, so that it may be well mixed with the soil. Green manuring with indigo seeds is so far as I have observed resorted to in one or two of the best potato-growing villages. The quantity of manures used depends not on the requirements of the fields or the crop, but on the means of the cultivators. Generally about 20 maunds of dung and 8 to 10 maunds of oil-cake are used per bigha. Half of the oil-cake is used at the time of planting, and the other half as a top-dressing when the plants are a second time earthed up.

Harvesting.

Except when the potatoes are intended for the early market, the ryots do not lift them till the plants die and dry up. The general harvest time is the end of Falgun. After the potatoes have been raised they are sorted, the largest and the middle-sized ones are sold, and the smallest are kept for seed and household use.

Diseases.

The most dreadful potato disease known to the ryot is *dhasa* or rot. This disease first makes its appearance on the root just below the ground, which rots, and the upper portion of the plant dries up. Hundreds of potato fields are sometimes totally destroyed by this disease, and the loss is immense. It does not seem that the disease is induced or even influenced by any peculiarities of the soil or

climate. It is very probably propagated through the tubers, and in the tubers if not induced, at least much aggravated, by continuous heavy showers and high temperature in Sravan and Bhadra. Another disease from which potatoes in Bengal sometimes suffer is curl, by which the leaves are curled up, and the plants at first become stunted in growth, and afterwards dry up altogether. Of the insect pest, a kind of red ant sometimes does great injury, making holer through the tubers at first, and then causing the death of the plants. These insects are found more in coarse-grained red sand than in any other soil. Fresh dung applied to potato fields is supposed to discolour the tubers, and gives rise to various kinds of insects.

Approximate cost of potato cultivation.

	Rs.	A.	P.
6 ploughings at 6 annas	2	4	0
40 baskets of dung	2	8	0
To apply the same, 2 men at 4 annas each	0	8	0
Oilcake, 8 maunds	9	0	0
To plant, 8 men	2	0	0
1½ maunds of seeds at Rs. 5 per maund	7	8	0
To irrigate, 2 men	0	8	0
Ditto	0	8	0
Hoeing, 5 men	1	4	0
To irrigate, 2 men	0	8	0
1st earthing, 4 men	1	0	0
To irrigate, 2 men	0	8	0
2nd earthing, 4 men	1	0	0
To irrigate, 8 times more	4	0	0
To lift, 8 men	2	0	0
Rent	2	0	0
	37	0	0

N.B.—The cost is very variable. Sometimes each time the field is irrigated the cultivator has to pay more than a rupee, and the seeds often cost as much as Rs. 20 to Rs. 25. The price of the oilcake in some years rises to Re. 1-8 a maund. If a field is to be planted with potatoes for the first time instead of 6, some 20 ploughings will be needed. The cost therefore may amount to nearly Rs. 60.

The yield again is even more variable. In some of the places now and then it exceeds even 80 maunds per bigha. If the plants are attacked with dhassa, it may come down to below 10 maunds. I think I shall not be much out of the mark if I put down on the average the cost of cultivation at Rs. 35, and the outturn at 50 maunds per bigha, worth as many rupees.

Suggestions for improvement in cultivation of this crop, which is of growing importance in suburban districts, will be found it part III, section 3.

2.—*Begun.*

Begun must be regarded as one of the most important of indigenous vegetables.

It is more or less cultivated throughout the division, but it is only in the Burdwan and the Hooghly districts that it is grown as a field crop. The best *begun* is that produced on both sides of the Damudar.

Soil.

The best *begun* soil is a high well-drained sandy loam. In clay soil the plant as well as the fruit are of stunted growth, and in soils containing excessive organic matter the plants grow too luxuriantly to bear much fruit.

Varieties.

The different varieties of *begun* are *muktakesi*, *elokesi*, *chhatere* and *makra*, of which the first and last are regarded as the best. There is also a variety of *begun* known as *douko* or *kuli begun* of which the fruits are small and spindle-shaped and which grows in bunches.

Seeds and seedlings.

Seeds are generally preserved by the ryots for themselves from the previous crop. For this purpose fruits are allowed to ripen in the trees till they become golden yellow; when they are fully ripe they are removed, and allowed partially to rot. This

is effected by cutting the fruits right through the middle and keeping them in a heap for a day or two. The seeds are then removed washed in water, and dried in the sun.

The seeds are first sown in a nursery, for which a cool and shady place is chosen. The soil must be sandy loam which is repeatedly ploughed or hoed by the *kodali*. The clods are carefully broken, and the ground is enriched with ashes, well-rotten dung, and the earth taken from the floor of the cow-shed. It is absolutely necessary that the soil should be well ærated and sun-burnt. After the soil has been well prepared for the nursery the plot of ground is divided into a number of small beds about 5 feet square each.

The time of sowing the seeds extends from the beginning of Chaitra to the end of Baisakh, more seeds being sown by the middle of Baisakh than before or later. If moisture sufficient for the proper germination of seeds, does not already exist in the soil, as is generally the case at this time of the year, the ground is watered, and after the excess of moisture has evaporated, then the seeds are carefully sown at evening. It is necessary to distribute the seeds as evenly as possible and to cover them lightly. *Begun* bears pretty thick seeding. For a few days it will be necessary to water the ground every evening, but an excess of moisture must be avoided. If the site of the nursery be much exposed to the sun, the ground is covered with date leaves or straw. The plants will come out in three or four days. Watering is continued as often as the plants require it. There may be a heavy fall of rain, then look after the drainage. Weeding may be necessary if the ground had not been properly prepared The seedlings are sometimes much injured by various insects.

Tillage.

The best way to prepare the land intended for *begun* is to hoe it once by the *kodali* at the beginning of Pous. It is necessary that this should be done as early as possible, as the fresh earth thrown up by the *kodali* requires to be well weathered. Hoeing by a *kodali* is an expensive operation, requiring 8 to 16 men per bigha, but experienced cultivators consider this operation as indispensable, for the plough does not go deep enough. But hoeing is seldom given, and the preparation of the *begun* field does not generally begin till peas and other *rabi* crops are off the field. The land is then ploughed at intervals of a week or so, and after the second ploughing the ladder is passed over the field each time it is ploughed. The land ought to be ready for planting by the end of Baisakh, if not earlier.

Transplanting.

Drains are made all round the field, and if the length of the field be great, a few water-channels are also made across it (plan No. 7). Now, by means of the *kodali* it is necesary to make a number of deep furrows, called *juli* or *nol*, at intervals of some 36 inches. The *begun* seedlings are planted in holes made at the bottom of these furrows at intervals of nearly 36 inches. The transplanting, if possible, should be done after a good shower of rain.

In some places after the field has been well prepared and levelled, the seedlings are planted on the flat at intervals of 36 inches either way. The water-channels are made afterwards.

Manuring.

When cow-dung is applied to *begun* fields, it should be given only in a well-rotten state. *Begun* fields are sometimes top-dressed with finely powdered old mustard cake at the rate of 2 maunds per bigha. The cake is applied to each plant separately, and not by spreading it over the whole field. Castor cake is not used in *begun* fields. This manure as well as cow-dung when fresh tends to encourage the growth of the vegetative part of the plant at the expense of its reproductive powers.

After-treatment.

When the plants have taken root the space between the rows is hoed by the *kodali*, and after about a fortnight the field is hoed a second time, and the plants are earthed up converting the furrows into ridges. Irrigation is not generally necessary before the month of Kartik, but if there be no rain for some time irrigate once, and then hoe and earth up the plant once more. In Kartik and thence forward irrigate once a month. The plants will begin to bear fruits, in the

beginning of Aswin, and will continue to give fruit till the end of Falgun. The late planted trees will not dry up till the end of Chaitra.

Begun fruits may be obtained almost all the year round by planting the trees at different times.

Varieties	Time of sowing seed.	Time of planting.	Give fruit.
Ordinary (early)	Falgun	Baisakh	Bhadra to Magh.
Ditto (late)	Baisakh	Ashar	Kartik to Chaitra.
Kuli	Aswin	Kartik	Falgun to Baisakh.

To obtain fruit from Jaistya to Bhadra, trees that have ceased to give fruit early, say at the beginning of Falgun, should be pruned, manured, and irrigated. Fresh shoots will be thrown out which will flower and bear fruit, but of somewhat inferior quality.

Diseases, &c.

The seedlings while still in the nurseries are sometimes much injured by a kind of green-coloured grub resembling much in appearance those feeding on cabbages. The young plants are sometimes totally destroyed by red ants. There is another insect which destroys both the plant and the fruits. Stagnant water is very injurious to *begun* plants. *Begun* plants are sometimes attacked by a disease known as *tulshimara* among the ryots, because the leaves of plants so attacked resemble in appearance those of (*tulshi ocimum villosum*). Such plants will yield no fruit, and as soon as the disease makes its appearance, are uprooted and thrown away.

Approximate cost of begun cultivation.

	Rs.	A.	P.
Ten ploughings at 6 annas each	3	12	0
Planting, 6 men	1	8	0
Hoeing 4 times, 4 men each time	4	0	0
Oil-cake, 2 maunds	2	6	0
To irrigate 3 times, 2 men each time	1	8	0
Plucking	1	0	0
Rent	2	0	0
	16	2	0

3.—Chillies.

There are several varieties of chillies under cultivation here, of which the most important ones are (1) the Patna and (2) the *deshi* or the country variety.

Soil.

Chillies may be grown almost on any soil, but they do best in sandy loam. They succeed very well in newly-formed alluvion. The best fields of chillies I saw were on the banks of the Meghna and the Ghoomti.

Rotation.

Chillies generally follow one of the pulses or oil-seeds, and are sometimes grown after potatoes. They are always followed by *aus* paddy.

Tillage.

The preparation of the field is exactly like that of *begun*.

Nursery.

The seeds are first sown in Baisakh in a nursery prepared in the same way as that for *begun*. The seedlings are ready for transplantation when they attain a height of 6 or 7 inches.

Planting.

When the land has been prepared it is levelled by the ladder, and after a fall of rain the seedlings are planted in rows about 27 inches apart, and at intervals of from 12 to 18 inches in the rows according to the richness of the soil. The time of planting extends from the third week of Jaistya to the end of Ashar.

After-treatment.

Particular care should be taken not to let rain-water stand in the field, stagnant water being most injurious. When the plants have got a good start, they must have their roots partially exposed to light. This is done by removing some

earth from the lines of plants. About a month after this is done the plants are top-dressed with either oil-cake at the rate of 2 maunds, or dung at the rate of 20 maunds per bigha. The plants are about the same time earthed up. The field should be kept as free of weeds as possible, and two to three weedings are generally given. Chillies seldom require irrigation, but if there be a continuous want of rain in Kartick, one or sometimes even two waterings will be needed. A hoeing is given afterwards.

Harvest.

Plucking may begin so early as Kartik in order to send green chillies to the market, but the proper harvesting season is the months of Magh and Falgun. The ripe chillies, after having been plucked, are spread in the sun to dry, and take 10 to 15 days to dry properly. Unless to guard against injury by rain, chillies need not be covered while they are being dried, for night dews do them no injury.

Ants sometimes damage chillies, by eating away the tender shoots and leaves.

Approximate cost of cultivation.

	Rs.	A.	P.
Ten ploughings	3	12	0
One man to plant	0	4	0
Hoeing, 6 men	1	8	0
Do. 2nd time, 5 men	1	4	0
Weeding, 4 men	1	0	0
Do. 2nd time, 3 men	0	12	0
Irrigation once, 2 men	0	8	0
Hoeing in Kartik, 4 men	1	0	0
Plucking 4 times, 1½ men each time	1	8	0
To dry, 4 men	1	0	0
Rent	2	0	0
	14	8	0

Yield from 2 to 5 maunds of dry chillies. A maund of chillies sells for 4 to 7 rupees.

4. *Tobacco.*

There are four or five different varieties of tobacco under cultivation somewhat in the division differing in the size, form, thickness, and flavour of the leaves.

Nursery..

The seeds are first sown in a nursery. For this a piece of high, well-drained, and light soil is selected, which is hoed several times and of which the earth is very finely pulverised. The seeds are sown in Ashar and lightly covered with earth. During rains the seedlings are protected by palm leaves. The plants come out in 8 to 10 days. Ants sometimes eat away all the seeds, but this may be prevented by putting ground turmeric in a line round the place where they have been sown. When the plants have got the third leaves, covering is no longer necessary, and the plants are fit for transplantation when they are 6 to 9 inches high.

Soil.

Tobacco does well in loam and river silt. It grows also well in *bastu* land, especially on the site of old cow-sheds. It can be planted with advantage on lands which had previously been overgrown with jungle, but have very recently been cleared.

Tillage.

The land if possible should first be dug up with the *kodali*. Then by the repeated use of the plough and harrow it should be well stirred and thoroughly pulverised. When the land has been prepared, in this way, it should be laid in ridges by the *kodali* at intervals of 18 inches, and the tobacco seedlings should be planted in the furrows at intervals of about 15 inches. Holes are made which are watered from a *kalsi*, and the seedlings are put in, one in each hole. The usual transplanting time is Aswin and Kartik.

After-treatment.

The plants should for some time be watered every second or third day. After they have got a good start give a top-dressing of well-rotten dung and dung ashes around their roots. The lines in which the plants have been put in are hoed and then covered with the earth taken from the ridges between them. The field should

be kept clean by one or two weedings. When the flower buds come out they should be carefully removed.

When the leaves get a little reddish in colour they are plucked, the lower leaves being removed first and are then made into small heaps consisting of three or four leaves and spread in the sun. After an hour or so they are made into bundles, each containing four or five leaves, and tied close to the leaf stalks with date leaves. A number of these bundles are now put one over the other in a heap in a cool place. At night these bundles are exposed to the dew. In the morning they are again put in heaps, and the process is repeated in case of good leaves for ten or twelve days, and in case of inferior stuff for less than a week. The leaves having been cured in this way are ready for sale.

The leaves are removed from the plants in three stages. The first crop is of the best quality and the last the worst.

XI.—Convolvulæcæ.

1.—*Sakarkand Alu—Sweet potatoes.*

Varieties

There are two varieties much resembling one another, of which the one having purple-coloured flowers and roots is known as *sakarkanda*, and the other having white flowers and white roots is called *chine alu.*

Soil.

Alu requires a sandy soil, and is generally grown on lands which will scarcely grow any other crop.

Tillage.

Five to seven ploughings are generally given. After the land has been levelled by the ladder, it is laid in ridges with the earth taken from a trench made on one side of the ridges only. Some lands on the other side of the ridges remain untouched, *i.e.*, we have a ridge, a trench, some untouched land, and then another ridge, &c.

This plant is propagated by cuttings to supply which creepers are grown near homesteads in a damp place. Before planting these creepers are pulled up and cut into pieces, each containing two knots, the portions close to the roots being rejected. These cuttings are planted on the ridges, one of the knots being buried in the ground, and the other remaining above it. The planting time is Bhadra-Aswin. When the cuttings have taken root, the ridges are properly made, and later on the plants are earthed up.

Harvest time extends from Kartik up to Agrahayan.

The yield is from 20 to 30 maunds per bigha. *Chine alu* sells from 8 to 10 annas a maund, and *sakarkand* from 12 to 14 annas.

A kind of thread-like worm sometimes grows inside the roots and does much injury to this plant.

XII.—Cucurbitaceæ.

This order supplies a considerable portion of the green vegetables which form an important part of an Indian's daily food. They are all creepers, and in most cases the fruits, leaves, and shoots are all edible. The fruits of some of these plants are eaten without cooking when ripe, and in some cases even when green. They mostly prefer a sandy soil, and are extensively grown on dearah lands. In the Burdwan district they form the characteristic crops of the *manas*, *i.e.*, lands lying between the beds and embankments of rivers, especially of the Damodar.

1.—*Potol.*

Three different varieties of this important green vegetable seem to be under cultivation. These differ in the size and colour of the fruit and leaves.

1. *Pero.*—The fruit and leaves are of a grass colour and larger in size than these of the other varieties.

2. *Deshi* or *pankāle.*—The fruit and leaves are of a black colour and small in size.

3. *Dhali* or *white.*—The fruit and leaves are of a white colour and of medium size.

Soil.

Sandy loam is best for this vegetable. Neither clay nor very light sand is good for it. It is extensively grown on river banks, and may be grown on soils containing an excess of common salt.

The land is prepared by five or six ploughings and harrowings. Holes are then made 60 inches apart. When *potol* creeps over the grounds, it sends adventitious roots from its joints which, together with portions of the roots below, are used for the propagation of the plant. These cuttings are made about 3 inches long. Each hole receives two pieces of cutting which are covered with earth. The earth should be well pressed, for otherwise the cuttings will dry up, and to prevent this it is necessary to cover the holes with straw and to water them constantly. When the plants come out, the ground should be well hoed. Stagnant water is very injurious to *potol*, and to prevent the accumulation of rain water on the field it should be divided into a number of long beds by drawing water channels up and down. Each bed contains one row of plants. The earth raised in making the trenches is thrown over the beds. If the field be a long one, one or more water channels are drawn across. To ensure rapid drainage the beds are given a slight slops towards the water-channels on both sides. *Potol* fields should be kept as free from weeds as possible, and till the ground is well covered with plants the weeds are kept down by two or more hoeings. The planting time is Aswin-Kartik, and the plants give fruits from Falgun to Aswin. If the ground be above the inundation level, the plants are kept up for one year more. When this is done the field is lightly ploughed in Kartik, and one or two hoeings are given afterwards.

Cost of cultivation.

	Rs.	A.	P.
5 ploughings	1	14	0
4 hoeings, 5 men each time	5	0	0
2 weedings, 4 men each time	2	0	0
Planting, 4 men	1	0	0
Cuttings	1	4	0
Rent	2	0	0
Total ...	13	2	0

2.—*Lau.*

There is a number of varieties under cultivation, differing in the size and in the form of the fruit.

Lau does best in sandy soil. That containing much organic matter causes the plant to run to leaves, thereby greatly reducing its fruit-bearing power. Lau is largely grown on the banks of the Hooghly, Damodar, and other rivers. In the homesteads of the cultivators, one or two plants are almost invariably to be found near the cow-shed and on the sites of old houses.

Two crops are obtained yearly. That sown in fields in Kartick supplies fruit all through the summer and the rainy seasons. A supply of the fruit for the winter is obtained from the crop grown on *bastu* lands in Jaistya. The plant seems to love a cold climate because the fruits obtained in the rainy season have not nearly as good flavour as that produced in winter.

Seeds are soaked in water for more than 24 hours before putting them in the ground. Holes are made in the field some 8 cubits apart; two to three seeds are put in each hole, and covered with a little fine earth. When the plants come out, the strongest one is kept, and the rest pulled away.

The only other operations needed are two hoeings and two weedings.

Some care is necessary to obtain seed. One or two fruits are allowed to ripen in the plant. When properly ripe they are removed; the neck is cut off, and through the cut portion a little dung mixed with water is introduced into the fruit. This induces fermentation, and the inside rots. The seeds then are taken out, washed and dried in the sun.

3.—*Kumra.*

Three or four varieties are under cultivation, differing in the size and from of the fruits. The fruits, flowers, leaves, and tender shoots are all edible. The fruits may be eaten when green as well as when ripe.

Two crops are taken. For the field crop the seeds are sown in Kartik, and the plants begin to yield fruits from Pous. On high grounds seeds are sown in Jaistya. Plants thus obtained will bear fruit from Sravan.

Before sowing, the seeds are soaked in water for 24 hours, then drained and enclosed in a fig or castor-oil leaf, and kept under a heap of ashes for about 48 hours.

4.—*Uchchhe.*

There are two varieties grown. The one bearing larger fruit is a rainy season crop and is known as *karela.* The other has smaller fruit and is cultivated as a summer crop.

The smaller variety prefers a sandy soil, and is largely grown on river banks. *Karela* likes a loamy soil.

UCHCHHE.

Treatment.

Prepare the field by three or four ploughings, using the ladder once or twice to crush any clods that might have been raised. Then make holes at intervals of 36 inches either way. In every hole put in three or four seeds that have undergone the preparation described under *kumra,* and cover them up with a little earth. The sowing season is the month of Kartick. When the plants have grown to a length of about a foot, take advantage of a fall of rain and give the field a hoeing with the *kodali.* The plants begin to bear fruit by the end of Magh.

KARELA.

Treatment.

This is grown on high and well-drained land. By the repeated use of the plough and the ladder stir up and pulverise the soil thoroughly. Then make ridges at intervals of about 60 inches. On these ridges the seeds, which have received the previous treatment described under *kumra,* are dibbled at intervals of about 60 inches. The sowing time is the month of Magh. The plants begin to bear fruits from Joistya. The plants when grown large enough are made to creep over raised bamboo structures. Before the plants grow large enough to overshadow the ground, one or two hoeings and two or three weedings will be required.

5.—*Jhinge.*

There are three different varieties under cultivation, differing in the form and size of the fruits and the way they are borne on the plants.

The three varieties are grown at different times of the year.

1*st.*—The rain crop or *thupi jhinge.*—This has the peculiarity of growing in bunches. It is grown only as a field crop.

It requires a high well-drained light soil, which is prepared by giving it four or five ploughings and two or three harrowings. When the land has been well prepared, ridges are made as in the case of *karela.* The seeds are dibbled at intervals of 40 inches on the ridges.. The plants are allowed to creep over the ground, and before it has been well covered, the weeds must be put down by one or two hoeings and weedings.

The plants give fruits during Sravan and Bhadra.

2*nd.*—*Variety.*—This also is grown, in, fields. The sowing time is Kartik, and comes generally after the *aus* paddy. The land is prepared by three or four ploughings and harrowings. The seeds are put in holes made at intervals of 60 inches. The only operation required afterwards is to give the land one hoeing with the *kodali.* The plants give fruit from Falgun to Joistya.

On the banks of the Damodar this variety is sometimes put in holes made at regular intervals in the standing *amun* paddy. When the latter has been harvested, the ground is dug up with the *kodali.*

3rd.—Variety.—This variety is grown around sugarcane fields or on *bastu* lands.

It is sown in Joistya and gives fruit from Bhadra to Kartik. In the first case the plants are allowed to creep over *arahar* grown as a border round cane fields to prevent cattle trespass, and in the other case on house tops or on branches stuck into the ground for the purpose.

Before sowing the *jhinge* seeds receive the same previous treatment as the seeds of *kumra* and *uchchhe.*

6.—*Tarmuj—Water melon.*

Two varieties are grown, which differ in the form, size, and colour of the fruits, viz. (1) *dhamashi*, and (2) *deshi.*

Tarmuj may be grown on all soil, but does best on sandy loam.

The seeds are sown in holes at intervals of 60. inches. The cultivation is similar to that of *jhinge.*

The sowing time is Kartik. The plants bear fruit from Falgun to Joistya.

When the plant comes over ground, the land receives a hoeing. Sometimes water channels are made, as in *potol* fields.

8.—*Sasha—Cucumber.*

Three varieties are grown, viz., (1) *hitli*, (2), *delo* and (3) *ankri.*

(1).—*Hitli* or *taito sasha.*

The land is prepared by five or six ploughings and three or four harrowings. The cultivation is similar to that of *tarmuj.*

Sasha requires three to four waterings.

The sowing time is Kartik. Plants give fruit from Falgun to the first fortnight of Baisakh. A red insect, resembling the glowworm in appearance, does much injury by eating away the leaves.

(2).—*Delo.*

Cultivation similar to that of *tarmuj;* sowing time is Pous; gives fruit in Sravan and Bhadra. It is made to creep over a bamboo structure. The land requires one hoeing.

(3).—*Ankri.*

Generally grown in bastu land. Sometimes raised in ginger fields.

Sowing time is Joistya; bears fruits from Bhadra to Aswin. It is made to creep over a bamboo structure.

10.—*Gomuk.*

Cultivation similar to that of *tarmuj*; sowing time is Agrahayan. The fruits make their appearance first in Joistya, but these will not ripen. Fruits are obtained in Ashar and Sravan. Ripe fruits only are eaten. The unripe fruits have an exceedingly bitter taste.

12.—*Kankur.*

Four varieties are grown. These differ in the size and form, and in the colour of their fruit. Cultivation similar to that of *tarmuj;* sowing time is Magh; gives fruit from Baisakh to Ashar. When green may be eaten raw as well as cooked. The ripe fruits are eaten uncooked, and are known as *fati.*

N.B.—Before sowing the seeds of *uchchhe, jhinge, tarmuj, sasha, gomuk,* and *kankur* all receive the previous treatment described under *kumra.*

XIII.—LEGUMINOSÆ.

The pulses.—These form a very important part of an Indian's food. Of the three important ingredients of human food, viz., the nitrogenous matter, the carbohydrates, and fat in an Indian's diet, the first portion is for the most part supplied by the pulses, boiled rice or wheaten bread; the pulses and

ghee mixed in due proportion form almost a chemically perfect food, the only drawback being the presence of excessive quantities of indigestible matter in some of the pulses.

As will be seen from the following table, given by Professor Kinch (Royal Agricultural College, Cirencester), soy beans (*soja hiyspida*), one of the pulses, largely grown in China and Japan, approaches very nearly to animal food in its composition. Not only does it contain a large percentage of nitrogenous matter and fat as well as carbohydrates, but the amount of fibre or indigestible matter in it is comparatively very small. Considering the important part the pulses play in an Indian's diet, it is to be regretted that no systematic attempt has yet been made to add soy bean to our farm crops. The single experiment made with it at Sydapet was not tried under very favourable conditions, as Mr. Benson admits. An effort will be made to introduce this bean in Burdwan :—

	Soy bean of Japan.	Peas.	Beans.	Lupins.	Lentils.	Lean beef.	Fat mutton.
Water	11·3	14·0	14·8	12·2	12·5	72·0	53·0
Nitrogenous matter	37·8	23·0	24·0	28·3	25·0	19·0	12·0
Fat	20·9	1·7	1·6	5·0	1·8	4·	32·0
Carbohydrates	24·0	53·8	49·5	36·4	54·6	.....	.....
Fibre	2·2	5·0	7·0	14·1	3·6	.....	.....
Ash	3·8	2·5	3·1	4·0	2·5	5·0	3·0

1.—*Peas.*

The different varieties under cultivation are (1) *deshi* or *bhurro;* (2) the white or the *Kabuli;* (3) the *pahari*, and (4) the *piyara.* Near the railway line between Howrah and Hooghly, English or *Olondo* peas are grown for the Calcutta market. These are all sold green at a very high price.

Soil.

Peas requires a naturally rich soil; they grow in clay or loam, but do best in loam. A sandy soil is not considered good for them; clay soil gives a heavier outturn.

Rotation.

They come after *aus* paddy and are followed by the same crop or by sugarcane or *kachu.*

Tillage.

The land for peas, unless it recives a yearly deposit of river silt, requires to be carefully ploughed. A good crop is not usually obtained with less than eight or nine ploughings. It is not necessary to pulverise the soil much.

Sowing.

Peas are sown either alone or mixed with mustard. In both cases 20 seers of peas are sown per bigha. The usual sowing time is Kartik.

Harvesting.

There is no after-cultivation; no weeding, nor irrigation is required. Peas are harvested in Falgun by pulling the plants up by the hand. As soon as harvested, they should be spread out and exposed to the sun, for if kept in heaps the colour is spoiled. The grains are threshed out by being trodden on by bullocks.

Yield.

The outturn is very variable; 4 maunds per bigha would be considered an average crop.

In lands receiving a yearly deposit of silt, just after the receding of the inundation water, peas are often broadcasted on the soft mud without any previous cultivation.

Diseases, &c.

In a cloudy weather a yellowish-green coloured small fly sometimes attack peas. Thousands of flies alighting on the plants lay their eggs on the immature pods. Caterpillars are born in due course, and these voracious creatures eat away almost the whole substance of the pods. The damage sometimes done in this way is very great. Stagnant water is very injurious; the plants if exposed to it wither and then dry up. In soils containing excessive organic matter, the plant sometimes grows too rank to bear much fruit. A kind of weevil also attacks beans if stored in barns. In the opinion of the ryots this happens when the grain heated in the sun, is stored up before it has cooled properly.

2.—*Kalai.*

There are three different varieties under cultivation, viz., (1) the *kashi* or the white, (2) the *thikere* or black, and (3) the *deshi* or the ash-coloured.

Kalai may be grown on clay or loam, but is generally grown on loam, as the clay soil in most cases being lowlying, is not dry in time to permit of its preparation for *kalai*.

Kalai comes after *aus* paddy, and may also be followed by that crop, or by *kachu* or *til*.

The cultivation is very simple: three to four ploughings and two or three harrowings are all that the land receives.

The seeds are broadcasted in Aswin at the rate of five seers per bigha.

The harvest time is Pous.

The outturn is about 5 maunds per bigha.

3.—*Mug*.

Varieties. There are three varieties, viz., the *sona mug* or golden *mug*, *Kreshna* or black *mug*, and *ghora* or horse *mug*.

Soil. This pulse requires a light friable soil, high and well-drained, and cannot be grown in clay soil.

Rotation. It comes after *aus* paddy, and is followed by the same crop, *arahar*, *kachu*, or *begun*.

Tillage. Four or five ploughings suffice, but the soil should be fairly pulverized.

Sowing. Sowing time is Aswin. About 1¾ seers of seeds are broadcasted over a bigha. The after-cultivation consists in hoeing the field once with the *kodali*—a process which encourages the growth of the plants.

Harvest. Harvest time is the end of Pous and first week of Magh.

Diseases, &c. Weevil attacks *mug* in the barn if heated in any way. *Mug* should be kept in a cool place. Some mix with sand, some rub with oil, and others mix with tamarind seeds to preserve the seed from attacks of weevils. The last is most efficacious.

Yield 2 to 2½ maunds per bigha.

4.—*Gram*.

Varieties. There are two varieties grown, viz., the straw-coloured and the white or *Kabuli*.

Soil. Gram requires a heavy soil. Does best in the clay or wheat soil. Can be grown in loam, but not in a sandy soil.

Comes after the *kele* paddy, a connecting link between the *aus* paddy and *amun*. Five or six ploughings suffice to prepare the land, fine pulverisation of the soil not being required.

Sowing. Gram may be sown alone or mixed with wheat. In the first case seven seers, and in the other case five seers are sown per bigha. The sowing time extends from the second week of Kartik to the first week of Agrahayan.

No after-cultivation is required. Harvest time is Falgoon. Threshing is effected by beating with a stick or treading under bullocks' feet. At the first beating or treading only the pods come out, the second and the third beating or treading gives the seed. The outturn is from 2½ to 6 maunds.

Diseases. Rain, especially after the pods have formed, is often followed by attacks of an insect which eats away the pods. Weevils attack gram in the barn.

5.—*Mashuri*.

There is only one variety grown here. The seeds are smaller than those of the Patna variety, but the plants are bushy and give a better outturn.

Soil. Does best in clay soil. In very light soil the plants wither away.

Rotation. Comes after *niali*, or *kele kartiksal* paddy, and is followed by paddy.

Three or four ploughings suffice. Clods do not do any harm. Should be sown when the land is fairly dry. If there be too much moisture in the soil the plants come out; but afterwards make no progress. Five seers of seeds are sown per bigha sowing time being from the beginning of Kartik up to first week of Agrahayan. Barley is sometimes sown mixed with *mashuri*.

Tillage.

Harvest in Falgun.

Yield three to four maunds.

6.—*Kheshari.*

Variety. There is only one variety grown in this division.

Soil. Requires a loam or clay. Sandy soil is not considered suitable for this pulse.

Comes after *aus*. In dearah lands it is sometimes broadcasted among standing *amun* paddy.

In *aus* land it is sown with barley or *kajili sarisha*, in which case the land should be ploughed and pulverized properly.

Seven seers per bigha are sown broadcast in Kartik; the crop harvested at the end of Magh or the beginning of Falgun.

Yield four to eight maunds.

Khesari straw is a very good fodder for cattle of all descriptions.

7.—*Arahar.*

Varieties. Two varieties are under cultivation, viz., the *deshi* and the *tumar*. The latter has longer pods and larger seeds. The seeds of the *deshi* variety are white, those of *tumar* are red.

Soil. High well-drained sandy or sandy loam are suited for this crop, which does not require a rich soil.

Rotation. It comes after *kalai* or mustard, and is followed by paddy, sugarcane, or large onions.

Tillage. Three or four ploughings suffice. The land is laid in ridges with the *kodali*, and the seeds are then dibbled on them at intervals of 9 to 12 inches. The sowing season extends from the third week of Jaistya to the end of Ashar. Sometimes a black *kalai* called *aushe kalai* is dibbled between the *arahar* seeds.

When the weeds grow strong, the ridges should be earthed up. This is sometimes done twice.

Tumar ripens first. The harvest time is the end of Falgun. The *aushe kalai* is harvested in Bhadra-Aswin.

The *arahar* plants are cut with *dao-kasti* or *sickle*. The seeds are removed by beating the plants against a wooden plank.

Yield 4 to 10 maunds.

Cloudy weather sometimes is followed by attacks of insect pests which eat away the seeds within the pods.

8.—*Rambha.*

Varieties. Two varieties are grown, of which one is known as *barbati* and the other as *rambha*.

Soil. Grows in loam and sandy soils; does not do well in clay soils.

Rotation. Comes after *aus* paddy and is followed by *aus* paddy, *begun* or *kachu*.

Five to seven ploughings are necessary. Requires a fine tilth.

Is sown alone or mixed with *kajeli* mustard. Sown in Aswin at the rate of five seers per bigha.

In the cloudy weather a small winged insect sometimes attacks the plant which when thus attacked ceases to grow.

Yield ½ maund to 2½ maunds. Sells at Rs. 4 a maund.

9.—*Sunn.*

This crop is largely grown on the banks of the Saraswati and the Magra khal.

Soil.

It requires a light soil, and cannot be grown with advantage in clay soils. It does not require good soil, and is therefore generally grown on inferior high lands which are not fit for growing the more important crops.

Rotation.

It comes after one of the pulses or mustard, and is followed by a pulse, sometimes by *shara* onions. When *sunn* is grown on good soil it is sometimes followed by potatoes.

Tillage.

It is not necessary to prepare the land well for *sunn*. Three or four ploughings are sufficient.

Sowing.

The seeds are sown broadcast. It is necessary to have the plants grown thick, otherwise they became bushy and coarse and give very inferior fibres. Twenty seers of seeds are sown per bigha. The best sowing time is the middle of Jaistya.

Harvesting.

There is nothing more required after sowing till we come to the harvest time, which extends throughout the month of Bhadra. After the crop has been harvested, the plants are made into rather large bundles tied with some smaller plants. The retting process adopted is similar to that for jute. *Sunn* gets retted very easily; under ordinary circumstances it will not take more than three days.

Extraction of fibres.

When the retting is complete, as many plants are taken at a time as can be easily grasped by the hand and washed by striking them against the water. The washed plants are taken up, and the stalks are broken close to the top. The fibres are then removed by pushing away the stalks from within them. The fibre is next dried in the sun and made into packets, each weighing nearly a pound.

Diseases.

A green caterpiller resembling that found in cabbage plants sometimes attacks the young *sunn* plants and eats away the leaves and tender shoots. Stagnant water is very injurious to *sunn*, and should not be allowed to accumulate in the field.

Sunn is regarded as a renovating crop, and is sometimes used as a green manure to enrich poor paddy land and land which have been infested with weeds. For this purpose after two or three ploughings about 10 seers of *sunn* seeds are sown per bigha by the end of Baisakh. The plants are ploughed in the month of Ashar. Sometimes also paddy and *sunn* seeds are sown together in the same field. When the plants have properly grown, the field is lightly ploughed and the ladder is passed over it. The paddy plants mostly recover themselves, but the tender and juicy *sunn* is buried under ground and dies. A few *sunn* plants remaining are removed at the time of weeding and buried in the soil. The ryots say this green manuring does as much good to the paddy as the application of a maund of oil-cake per bigha. This practice is not, however, very widely extended, though the advantages of it are well known in Burdwan. It involves, however, early ploughing of the paddy lands and some extra labour which the ryot is not always able or willing to give.

11.—*Dhainchi.*

This is sometimes grown as a hedge round sugarcane and *begun* fields to prevent cattle trespass. It is considered the best crop to use as a green manure. For this purpose after two or three ploughings seven or eight seers of seeds are broadcasted per bigha in Baisakh. In Ashar or Sravan, when the plants have attained a height of 25 to 30 inches, water is collected in the field and the *dhainchi* is ploughed in. The paddy seedlings are transplanted a fortnight after the *dhainchi* is thus ploughed in. In the opinion of the ryots, this green manuring does more good to the land than oil-cake applied at the rate of one maund per bigha, and green manuring with it is more widely practised, especially on the heavier soils.

Sometimes a kind of coarse fibre is extracted from dhainchi by retting it like jute. The stalks are used in betel gardens.

XIV.—Lineæ.

1.—*Linseed.*

Linseed is not a crop which is grown throughout the whole division. It is more largely cultivated on the dearah lands than anywhere else.

Soil.

It is grown on all the different classes of soils comprised between the lighter class of clay and sandy loam. Linseed is supposed not to do as well in stiff clay as in light sandy soils. The land must be well drained, stagnant water being most injurious to this crop.

In the cultivation of this crop one or other of the two following methods is adopted, according as it is grown in the interior on clay lands or on the dearah lands on the beds and banks of rivers.

(1).—*On clay lands.*

Here the plan adopted for growing linseed is the simplest imaginable. As soon as the paddy field has become sufficiently dry, linseed is broadcasted on the standing paddy at the rate of two seers per bigha. The paddy is harvested as usual, the linseed being left to be reaped in Chaitra.

(2).—*On the Dearah lands.*

Here linseed is sown either alone or mixed with wheat, gram, mustard or *kheshari.* Sometimes more than two of these crops are grown together.

The land for linseed receives three or four ploughings and two or three harrowings. Linseed should not be buried deep, otherwise the seeds will not germinate properly. The seeds are therefore not ploughed in, but simply covered by passing the ladder over the field once or twice. When sown with such a crop as gram or wheat, the plan adopted is this:—After wheat or gram has been sown, the land is ploughed. Linseed is now broadcasted, and the operation is finished by using the ladder twice.

Time of sowing	...	...	Aswin-Kartik.
Harvest time	...	...	Chaitra.
Quantity of seed per bigha		...	Three seers when sown alone, one-and-a-half seers when mixed with other crops.

The yield is very variable. About two maunds would be considered a good average crop when sown alone. Linseed straw is used as fuel.

XV.—Tilliaceæ.

1.—*Jute.*

Jute is a fibrous plant of the Tilliaceæ order. "It is a native of India, and has been used for many years in the textile fabrics of Asia. Its importance as an exportable product dates principally from the cotton crisis created by the war of secession. Then the British trade took advantage of the cotton scarcity to develop the resources of jute as a cheap staple applicable in many European fabrics."

The soil most suited to the growing of jute is alluvial sandy loam. The banks and charas of large rivers are chosen by preference by ryots for its cultivation. In the Burdwan Division it is in the Hooghly district, along the right banks of the Hooghly river, that it is most extensively grown. Clay soil is not considered good for jute. If possible, lands above the inundation level ought to be selected for it. When jute fields are inundated, the fibres of the lower part of the plant are spoiled and become useless. A damp hot climate with plenty of rain is an indispensable condition for its successful cultivation.

Varieties.

There are two different varieties of jute grown in this division. *Corchorous olitorius*, having cylindrical capsules, is grown in the Culna sub-division of the Burdwan district, and *C. capsularis*, having globular capsules, is cultivated in the southern part of the Hooghly district. This latter variety is very extensively

grown in Eastern Bengal, especially in the charas of the Meghna and the Brahmaputtra.

Tillage.

In the rotation of crops, jute generally comes after one of the pulses. After this latter crop has been harvested, the land is ploughed on the first fall of rain. The field is afterwards repeatedly ploughed, and the clods are crushed by the ladder, as jute requires a good tilth. Altogether four or five ploughings are given to prepare the land. It is better to give two ploughings at intervals of about a week, and to leave the soil exposed to sun and air for some time, then to finish the preparation of the land by two or three ploughings more.

Sowing.

The sowing time in this division extends from the last week of Baisakh to the first week of Jaistya (the month of May). An early crop generally brings more money to the cultivators, but an early sown crop is liable to the risk of being burnt up for want of water. The quantity of seeds required is 1½ seer per bigha. Before sowing the field is smoothed with the ladder and ploughed slowly and superficially. The sowing of jute seeds is rather a delicate operation, and can only be done well by experienced ryots. To ensure uniform distribution of the seed, it is sown in three lots along and across the field as well as diagonally. The operation of sowing is finished by smoothing the field well by running the ladder over it.

The thorough eradication of weeds is a most essential point in the cultivation of jute. Weedings begin when the plants are about a foot high. The number of weedings varies with the nature of the soil, the amount of tillage that has been previously given to it, and the rainfall. Sometimes so many as four weedings will be required. If the field be very unclean, a common practice is to harrow it with the *bida*, to wait for two or three days to let the plants recover themselves, and then to weed by means of the *phor* already described. Thinnings become sometimes necessary. The plants which when they once get a start grow exceedingly fast; should be about nine inches apart.

Harvest.

When the plants bifurcate at the top and begin to flower, they are cut with the sickle about one inch above the ground. A few plants on an elevated part of the field are left to supply seeds for future use. After the plants have been cut, they are kept in heaps for two or three days, when the leaves are thrown off by shaking. The small plants are removed, and by means of them the large plants are made into sheaves. Large bundles are then made, each containing about 10 to 12 sheaves. These are taken to a reservoir of water, generally to one of those irregularly-shaped small ponds to be met with almost invariably near the house of a Bengali ryot, in which about 30 to 40 of these bundles are then kept floating, being tied together by small jute plants. A quantity of these small plants is also placed on the bundles, and over them such a quantity of pond mud as will keep the bundles immersed in water without causing them to fall to the bottom. The quality and colour of the fibre will depend much on the care with which this steeping process is watched. Jute takes from a fortnight to a month to ret properly, the time depending on the temperature and the maturity of the plants. When the process is nearly complete, one or two stalks are examined from time to time to see if the fibres will come out easily.

To extract fibres.

When the plants have been well retted, the bundles are untied and the sheaves are taken one after another. A man standing in the water holds one of the sheaves in his left hand and with the right hand strikes on it with a piece of wood. The stalks are then broken at a distance of about one foot from the bottom end, and the fibres of this portion of the sheaf are wound round the palm of the hand. The rest of the stalks are removed by pushing them against the water. Another plan is to take the bundles of jute out of the water, and to remove the fibres of each stalk separately. This is not only a tedious process, but it has the additional disadvantage of discolouring the fibres. The colouring matter in the bark of the plant, when once dried on the fibres, is extremely difficult to remove. The fibre is then well washed in the water and left to dry for two or three days. When sufficiently dry they are made into

hatas, each *hata* containing the fibre of from 25 to 30 plants tied at the top end: 20 to 25 *hatas* will weigh 5 seers. The harvest time extends from the last week of Sravan to the first week of Aswin.

The trees left for supplying seeds are cut at the proper time and made into sheaves. The tops are removed and left to dry in the sun. The seeds are threshed out by beating the dry tops with sticks. They are cleaned by winnowing with the *kula*, and kept carefully.

Diseases, &c.

Storms sometimes knock down the jute plants and do much damage. Stagnant water is very injurious round the plants when young. They also suffer from continuous drought.

In the Hooghly district, after the jute has been cut away, the field is occasionally transplanted with paddy. Only a half crop is obtained this way.

Manures.

While the ploughings are going on jute fields receive about 30 to 40 bags of dung per bigha. In Ashar, when the plants are in a forward condition, about 2 maunds of oil-cake per bigha are used as top-dressing.

In Eastern Bengal jute is regarded as an exceedingly exhausting crop, but the ryots of the Burdwan Division are altogether of a different opinion. Here the large amount of leaves thrown off from the jute plants, and their roots, are supposed to serve the purpose of green manuring the field and thus increasing its fertility. But it must be remembered that in East Bengal the cultivators, generally speaking, take no trouble to manure their fields, and in this respect they have much to learn from their brethern in Burdwan, whose practice of using manure they might followed with advantage.

XVI.—Malvaceæ.

1.—*Cotton.*

Cotton was at one time extensively grown in the Burdwan Division, especially in the western parts of it. But its cultivation has greatly declined, and it is no longer considered a paying crop.

Varieties.

There are two different varieties under cultivation. The one known as *norma* is grown as a rain crop and the other, called *khero*, is a winter crop.

Norma.

Soil.

This variety of cotton requires a high well-drained light soil on which there must be no possibility of rain water accumulating.

It comes after *kalai* and *mug*, and is followed by *sakurkanda*.

The land should be thoroughly stirred to a great depth and well pulverized. The rustic saying is *shatek chase mula, tahar ardhek tula, i.e*, radish requires a hundred ploughings and cotton half that number.

The land for cotton is laid out in ridges by the *kodali* at intervals of 30 inches, and the seeds are dibbled on them from 10 to 12 inches apart. Three or four seeds are put in the same hole. When a number of plants come out the two strongest are left and the rest are pulled out.

During the rains the ridges are once earthed up, and the land is given two weedings with the *phor*.

The plants begin to flower by the end of Sravan and the pods are ready for the harvest in Aswin-Kartik. The pods when plucked are spread in the sun and the coverings removed.

Before dibbling in the seeds they are soaked in water for 12 hours, then drained and rubbed with cowdung ashes, with a view to hasten germination.

Cotton fields are generally manured with well-rotten cowdung and dung ashes.

Cotton seeds steeped in water are sometimes mixed with bran and oil-cake and given to cattle.

Khero.

Khero may be grown in all soils, clay or sand, low and high, but does best in loam high and well-drained.

It comes after *aus* paddy, and is followed by *kele* paddy or *neali.*

Tillage. The land should be well ploughed and harrowed.

Khero is sown either alone or, as is more commonly the case, mixed with *kalai* or *mug.* The seed of both *kalai* and cotton is separately sown broadcast, the cotton seed receiving the previous treatment mentioned above.

Five seers cotton seeds, five seers *kalai* or two seers of *mug* are sown per bigha.

After the *kalai* or *mug* is off the ground, well rotten dung and dung ashes should be spread and then the land is dug well with the spade.

Harvest time is Jaistya-Ashar.

XVII.—Cruciferæ.

1.—*Mustard.*

Varieties. Three varieties of mustard are under cultivation in the Burdwan Division, viz., (1) *jhuni,* (2) *kajle,* and (3) *rye.*

(1) *jhuni*—plants large, seed black.
(2) *kajli*—plants small, yield greatest, seeds black.
(3) *rye*—plants of middle size, seeds white, yield smallest.

Rotation. Comes after *aus* paddy and is followed by *aus* paddy, *kachu,* ginger, &c.

Sowing. *Jhuni* mustard can be sown alone or mixed with gram, wheat and peas.

Kajli may be sown alone or mixed with *masuri* and *teora.*

Rye is grown only mixed with peas.

Time of sowing—

Rye and *jhuni* ...	... Kartick.
Kajli ...	... Aswin and beginning or Kartick.

Tillage. For *kajli* when sown alone, the land should be well ploughed. Six or seven ploughings are given and the soil should be well pulverized.

One-and-a-quarter seers of seed are broadcasted per bigha. Before the plants begin to flower, water channels are made, dividing the fields into beds as in the case of large onions, and the plants are irrigated once.

When mustard is sown mixed with other crops, from one half to one seer of seed is required.

Harvest. Harvest time of *jhuni,* Magh, Falgun; *rye,* Magh, Falgun; *kajli,* beginning of Magh.

When sown alone *jhuni* gives ½ to 5 maunds; *kajli* 2 to 6 maunds.

Kajli fetches a higher price than either *jhuni* or *rye.*

2.—Cabbages.

Cabbages are very largely cultivated in the Ghatal sub-division, especially in the neighbourhood of Gopiganj, and the cultivation is extending every year.

It is curious to notice that the ryots have almost instinctively selected the very spots for the cultivation of this important vegetable which science from a study of the composition of the plant, as well as from the composition of the manures applicable to it, tells us would be most suitable for this purpose. It is well known that common salt plays a very important part in the cabbage plant, and that it should be one of the ingredients in manures intended for it. It is also known that cabbage prefers a clayey soil retentive of moisture. Along the right bank of the Rupnarayan places are to be found, here and there, where the soil is clayey in character and has salt in such proportion as not to be injurious to plant life, but yet sufficient for the luxuriant growth of cabbages. These are the places which the ryots have chosen for their cabbage fields.

In this country cabbages cannot be grown without artificial irrigation and cabbage fields are therefore situated close to *khals*, tanks or *jhils*. Unlike Behar, fields are here seldom irrigated from wells.

Seeds and seedlings.

The seeds used mostly come from America and partly from the well-known firm of Sutton and Son of Reading (England). The ryots get their seeds mostly through Hriday Sarkar, the well-known cabbage grower and seller of foreign vegetable seeds in Kalighat, Calcutta. The seeds are bought at an exorbitant price. This year (1885, September) the seeds were sold at first at Rs. 40 a seer, but when the crop failed on account of the heavy rains of October, the price was raised by 50 per cent. Very good cabbage seeds might, I think, be imported for one-third this price.

The varieties generally cultivated are the drum-head, sugar-loaf and large York.

The most difficult part in the cultivation of cabbages is the raising of seedlings—a difficulty which is much increased when cabbages are grown for early market, for then the seeds must be sown before the rainy season is hardly yet over, and even a moderate shower of rain irrecoverably injures the delicate cabbage seedling. The soil in which the seeds are put in is prepared with almost superstitious care. A quantity of earth is taken from a field which is naturally rich and light in texture. This is rubbed with the hand somewhat in the same way in which soil is prepared for chemical analysis. It is then exposed to the sun and air. When quite dry it is ground by the *dhenki* (the lever and the mortar arrangement) and passed through a fine sieve. The earth so prepared is kept carefully in a corner of the house, and from time to time spread in the sun till sowing time comes. For sowing the seeds a bamboo platform is made about 2½ feet from the ground, 5 feet broad, and of convenient length. The platform has a moveable cover of *hogla* mat, resembling the roof of a country boat. On this platform the soil prepared in the way described above is spread evenly to a depth of about 2 inches. Before sowing, the seeds are immersed in water contained in a basin which is exposed to the sun. This is done at about 10 o'clock in the morning. After about 2 hours' exposure in this way one or two of the seeds begin to split, when all are thrown into a cloth bag and kept hanging in a dry but cool place. An hour before dusk the seeds are thinly sown on the dust-like earth over the platform. A little more of the prepared earth is then very carefully spread over the seeds, which are thus lightly covered over. The next operation is to water or rather to damp the earth on which the seeds have been sown. This is a very delicate operation, and is done this way. Taking a mouthful of water the cultivator blows this into the air over the platform, when the water falls on the earth in minute drops. This is repeated till the earth has got sufficient moisture for the proper germination of seeds. The plants come out in a day or two. The earth is kept moist for about a week by watering it every morning and evening. The platform is kept covered from about 8 A.M. to 4 P.M., and while rain is falling. For the early crop the seeds are sown by the middle of Bhadra, when the rainy season is not yet over, and the cultivator must, as already observed, watch carefully that the delicate seedlings may not be destroyed by rain. When the plants begin to put forth the third leaves, they are carefully removed one by one to a nursery, the soil of which has been prepared with care. The soil in the platform on which the seeds are sown should be light. A sandy loam is considered best for this purpose, but a clay soil is preferred for the nursery. The nursery (*hanpar*) is made on a piece of high well-drained ground. It is made about 5 feet broad and of convenient length. Drains are opened all round. The soil of the nursery is made in the same way as that of the platform on which the seeds are sown, but it is only partially broken, and not reduced into a fine dust. The plants are removed from the platform one by one by holding them with the thumb and the middle finger, and are put in thinly in the nursery ground. Water is then given round them by the nozzle of the brass vessel called *gadu*. The platform has a moveable hogla cover, the removal and the putting in of which is carefully regulated so as to make the young plants gradually accustomed to the increasing power of the sun's rays. When the plants are about 7 or 8 inches high, they are transplanted to the field. It is better that this should not be done while the plants are still very young and delicate.

Cultivation.

As already stated, the land selected for growing cabbages is clay containing sufficient common salt for the proper growth of this salt-loving plant. The plant being a voracious feeder, virgin land is considered best, and cabbages are not planted on the same land for more than two years consecutively. The land is seldom ploughed, and when ploughed, the field is carefully levelled by the *mai*. By means of two pieces of stick and a rope, the field is lined both ways at intervals of 27 inches. Square holes are then made with the *kodali* where the lines intersect. These holes are made in the form of cubes, each side measuring about 13½ inches. Part of the soil is raised and put in parallel lines, and a part is simply loosened, but kept inside the hole. About ¼ seer of oil-cake finely ground is then put in each hole and mixed with the earth so loosened. Should there be no rain at this time, the earth and the oil-cake thus mixed together are to be sprinkled with water. The oil-cake takes about 10 to 15 days to rot, when the field is ready to receive the cabbage plants. The seedlings are transplanted in the dry soil, to which water is afterwards poured from a *ghara*. For three or four days the plants have to be protected from the sun. This is done either by means of baskets made of *sal* leaves or by pieces of plantain stalks. During this time the plants should also be watered every evening. The ground is then allowed to dry a little. Three or four days after this, watering is again necessary, and thenceforward only once a week. When the plants have grown a little, the soil round them is stirred with a small implement called *phor* or *dauli*. The next operation is to hoe the land between the plants, which is done by the *kodali*, when plants receive another watering. Oil-cake is then applied a second time as a top-dressing round the stem. Two handfuls of oil-cake are applied to each plant. The ground is once more stirred with the *phor*, and then after about a week again hoed with the *kodali*. After this the only operation necessary is to water the field once a week.

Cabbage plants are sometimes attacked by a kind of caterpillar having exactly the same colour as cabbage leaves. When this is the case, the insect is to be picked off and killed every other day. This should be done very early in the morning, for when the sun rises the insect takes shelter inside the plant, and is difficult to find.

Time of sowing seeds—middle of Bhadra.

Time of transplanting—middle of Aswin.

The crop is ready for the market—end of Pous.

Number of plants per bigha—nearly 3,000.

Quantity of manure used—15 to 18 maunds of oil-cake per bigha, costing as many rupees.

Cost of cultivation—about Rs. 75 per bigha.

Market price of plants—all these cabbages are sent to the Calcutta market. For a short time they are sold very dear, fetching as much as from Rs. 22 to Rs. 25 per every hundred. The price soon goes down, and is at last reduced to Rs. 2 a hundred.

3.—*Radishes.*

In the southern part of the division, especially along the banks of the Rupnarayan, Damoodar, and the Hooghly, radishes are very largely grown.

Varieties.

There are three or four varieties under cultivation. An important variety having a beautifully rose-coloured sweet and large root is very fast driving the old varieties out of cultivation.

Soil.

High and well-drained sandy loam is the only soil on which radishes can be profitably grown.

Rotation.

Radish is a winter crop and comes after *aus* paddy.

The land intended for radishes requires to be very deeply stirred and thoroughly pulverized. To do this with the implements at the disposal of the Indian cultivator the ground should be repeatedly ploughed and harrowed. The rural saying is *Satck chase mula*—radishes require one hundred ploughings, and though the number of ploughings actually given does not come up to this high figure, it is not less than 15 even in dearah lands. Radishes do best on lands that have not grown any crop after the *rabbi* crop

was harvested. When this is the case, the ploughings should begin as soon as the paddy transplantation is over. All through the rainy season they should be ploughed as often as weeds make their appearance. This method has the great advantage of supplying the earliest crop. When radishes follow *aus* paddy, ploughings begin as soon as this latter crop has been harvested.

Sowing.

The sowing season is Aswin-Kartik. About one seer of seed is broadcasted on a bigha of land. Great care is necessary to distribute this small quantity uniformly over the ground.

After-treatment.

The seedlings make their appearance in less than a week. After about a fortnight the field is once weeded, when the plants should be thinned out to about nine inches apart. The next operation is to hoe the field with the *kodali*. This greatly encourages the growth of the plants. The number of weedings the field receives depends on the character of the soil. Sometimes so many as four weedings are given.

Diseases, &c.

When the plants are still very young they are sometimes much injured by insects. Too much rains make the plants run to leaves.

CHAPTER IV.

Live Stock.

Under this head there is not much to learn from the ryots. Much care is not bestowed by them on their working bullocks or milking cows, and in this respect the Indian practice compares very unfavourably with what is done by cultivators in other countries. In most places cattle are born, grow, and die without giving much trouble to their owners. I do not deny that the ryots generally are kindly disposed towards their working animals, and the Hindu ryots venerate them as demigods. But these fine sentiments do not lead to much in the way of active sacrifice for the alleviation of the wants and sufferings of these animals.

Food given to cows.

Just after calving a cow gets some *dhan* (unhusked paddy), ⅛ seer of mustard oil, and ½ seer *kukur songa*.

For about a fortnight after calving the cow gets only dry food and as little water as possible. Her daily food for this time consists of—

Paddy straw	...	...	10 to 12 sheaves
Oil-cake	...	...	½ seer.

The oil-cake is mixed with water and made into a thin liquid, which is poured on the chopped straw.

If milk fever sets in, the oil-cake is not mixed with water but thrown dry on the straw. No medicine is given, but the temple and the stomach are rubbed with mustard oil. The calf with its mother is kept in the cow-house for a fortnight and allowed all its mother's milk. After this period it is gradually weaned, but is allowed to run with its mother, who is now milked, on the grazing ground. It at first licks saline earth, and then gradually begins to eat young grass.

The food of a milking cow after the calf has been weaned consists of—

In the morning	...	..	Straw, 1½ to 2 gandas. Oil-cake, ¼ seer.
At noon	...	...	½ to 1 seer of boiled rice. 1 to 1½ seer bran, or 1 to 2 seers bhusi.
In the evening	...	...	Straw, 2 gandas. Oil-cake, ½ seer.

The poorer ryots, however, keep their cows in the fields and the grazing grounds the greater part of the day, and leave them to help themselves as best they can. When their cows return home they are given each—

A little green grass, some straw, and about ¼ seer of oil-cake.

Cows when not giving milk graze in the field throughout the day. In the evening they are given—

Straw	4 to 5 sheaves.
Oil-cake	¼ seer.

Food given to working bullocks.—During the working season bullocks get each in the early morning 3 or 4 sheaves of straw and about ⅛ seer of oil-cake.

At 1 P.M, when the ploughing is over—

Straw	2 gandas.
Oil-cake	½ seer.

In the evening—

Straw	1 ganda.
Oil-cake	⅓ seer.

A large bullock of the Bhagalpur breed will consume daily—

Straw	10 gandas.
Oil-cake	2 seers.

When the bullocks are out of work, the poorer class of ryots leave them to roam over the grazing ground all day, and in the evening give them about 2 gandas of straw and ¼ seer of oil-cake each. Well-to-do ryots, however, keep their bullocks on pretty much the same food throughout the year.

Cattle diseases and their treatment.

All the diseases which cattle suffer from are known among the ryots as '*paschimas.*' The most common of these 'paschimas' are—

1. Paschimé.
2. Jhima paschime.
3. Khor paschime.
4. Hota paschime.
5. Nela paschime.
6. Ora paschime.
7. Dheno paschime.
8. Muda paschime.

1. *Paschime*—Symptoms: Fever attended with shivering and trembling. Duration three or four days; generally prevails in summer.

Treatment followed by the ryots—Take—

Apang root	4 ratis,
Ginger	1 tola,
Pepper	4 to 5 gandas,

ground in a mortar and given in one dose.

2. *Jhima paschime.*—This is a severe cold in the head attended with fever. The animal feels very drowsy and remains with its head drooping half unconscious.

Treatment.—A fire is made in the cowshed with paddy husks, into which is thrown a mixture of—

Dried radish root.
Dried *jhinga* fruit.
Old *begua* root.
Dried rind of a plantain fruit, the axis inside the jack fruit, well dried.

The door of the cowshed is closed and the animal is made to inhale the smoke.

The ashes are afterwards taken and mixed with the juice of *datura* or bean leaves and rubbed over the body.

Now are taken—

Joan	⅛ seer,
Rock salt	⅛ seer,

well ground in a mortar and mixed with some tobacco pipe water and made into three pills, of which one is given at intervals of an hour. This generally brings about a cure, but sometimes the disease turns into *khor pascheme.*

3. *Khor paschime.*—When attached with this desease the animal becomes lame, the horns are covered with slaked lime, and the temple is rubbed first with mustard oil and then with a half tola of *akonda* milk. The leg is rubbed first with mustard oil and then with *neem* leaves heated over the fire for a minute.

As little water as possible is given, but when necessary to allay thirst, a small quantity of washings of husked rice, not more than a seer a day, may be given.

The food given during the time the disease lasts is green grass, partially dried watery, and old straw.

4. *Hota paschime*—Violent fever attended with shivering. Duration three or four days. Sometimes fatal.

Treatment followed by the ryots.—Small quantities are taken of—

Kodali kumli root.
Kukur songa root.
Akanda root.
Pepper ... 11¼ gundas,

and ground in a mortar and given in one dose. The animal is made to inhale ganja.

Or a dry *dhondol* is taken, the seeds are removed, and it is lighted at one end, the other end being put close to one of the nostrils; while the other nostril is kept closed.

For drink, water in which some *neem* leaves have been boiled is given.

5. *Nela paschime.*—Diarrhœa attended with salivation and loss of pulse.

Recovery is possible only before the salivation has commenced; after that period the disease is beyond treatment. Dies within 24 hours of the attack.

Treatment—Take a seer of pepper, roast it a little, and then reduce it to a fine powder. Mix together one-eighth seer of ghee and half a tola pepper thus powdered. Give it every hour.

Every attempt should be made to keep the bowels open, for as as soon defœcation is stopped, salivation begins and the disease runs a fatal course.

Give pure cold water to drink.

When the animal is on the way to recovery, but continues to void watery dung, take quarter seer of water, quarter tola of red clay and half tola of mustard oil. Make into an emulsion and give to the animal to drink in one dose.

6. *Ora paschime*—The symptoms are, that the animal which was hitherto in good health all at once gets swollen.

Treatment.—A red hot iron rod is taken and with it first a mark is made round the affected part, which is then burned carefully.

Now take—

Sweet *akonaa* root	...	...	...	...	4 ratis,
Sweet *karavi* root	...	...	..	...	4 ,,
Kanak datura root	...	...	...	...	4 ,,
Joan ...	...	..	...	..	$\frac{1}{16}$ seer,
Ginger ...	...	...	...	...	$\frac{1}{16}$ seer,

grind in a mortar, and give in one dose. For drink give *neem* leaf water.

7. *Dhêno paschime.*—One part of the body is swollen, and on this being pressed another part gets affected, and so on till the disease spreads over the body, and the head of the animal is reached.

Treatment—With a red hot iron make mark round the neck.

Boil in one seer of water—

Gulancha	...	...	...	...	½ seer,
Sugarcandy	...	..	...	...	⅛ ,,
Joan	...	...	...	...	⅛ ,,

and when reduced to ½ seer, cool the water and mix with it molasses ¼ seer. Make four doses and give one every two hours.

If the animal still continues to tremble, put in a cloth bag some hide salt or a portion of ant-hill powdered into a fine dust. With this foment every part of the body. This is the treatment followed by the ryots.

8. *Muda paschime symptoms.*—Suppression of urine and dung generally following an attack of fever.

In 1¼ seer of water boil—

Gulancha	...	...	...	...	⅛ seer.
Potal root	...	...	...	...	1/16 ,,
Challapata	...	...	...	...	⅛ ,,

When reduced to ⅓ seer, cool it, and when just tepid warm, let the animal drink it.

After an hour take—

Ginger juice	...	...	...	...	⅛ seer,
Ghalghasia leaf juice		...	...	...	½ tola,

and add pepper finely powdered 1 tola. Apply this juice into the nostrils, ears, and eyes of the animal.

9. *Aosha*—fever with eruptions in the mouth and feet. Not fatal to grown-up animals.

Wash the affected parts, that is to say, the feet and mouth, with *neem* leaf water, and apply tar or mustard oil in which garlic has been roasted. Kerosine oil is sometimes used.

Give the animal boiled rice and soft grass to eat.

The above list only includes the more common diseases, and the treatment described is that known to, and practised by, the more intelligent of the ryots; but besides the diseases named, epidemics occasionally break out and cause much loss, for which no remedies are known.

PART II.

CHAPTER III.

EXPERIMENTS.

Agricultural experiments were made in accordance with plan sketched in the Government resolution dated the 2nd May 1885, and described in detail in the letter of the Director of the Agricultural Department, No. 16, dated the 26th May 1885.

(*a*) *Manure experiments.*—These were tried on paddy, sugarcane, and potatoes—the three most important crops of the division. Owing to the lateness of the season when work was begun, the experiment with sugarcane, and to some extent also with paddy, could not be made so systematically as they ought to have been. Arrangements have, however, been made to carry on a series of regular manure experiments with paddy, sugarcane, as well as with other important crops of the division at the Burdwan experimental station, where results can be accurately ascertained during the coming year in addition to experiments to be made through ryots and talookdars.

I.—*Paddy.*

The paddy and the sugarcane experiments were made under the most unfavourable conditions possible, and the results, though not very striking, are better than I expected. When work was commenced, the time for rice planting had almost passed, and the manures were mostly used as top-dressings. It was not without much difficulty that the ryots could be induced to try manure or other experiments on their fields. They would allow me to apply the manures only to the most backward and sickly fields, and would not tolerate any interference with fields promising to give a fair average outturn. The excessive rains in the month of August again interfered much with the efficiency

of the manures used, some of which were highly soluble. The crops of some of the fields experimented upon were altogether washed away by the floods, others were submerged under water, and the plants were more or less destroyed. If the ryots' opinions can be relied upon,—and in matters like this they are the severest of critics,—the experiments have been more successful than the figures would indicate.

Bone meal, I think, would prove to be a very valuable manure for paddy, and owing to the peculiarity in the mode of cultivation of this the most important crop of the country, bone in this raw form is much to be preferred to the highly soluble superphosphate. One remarkable instance of the usefulness of bone as a manure was brought to my notice. A quantity of rather coarsely-broken bones was given to a ryot for manuring one of his paddy fields. From this he gave a few large pieces to a neighbour, and these the man put inside two clumps of paddy. These two clumps grew so luxuriantly that any one passing by the field could distinguish them from the rest of the crop, and the result was that the ryot in question has this year purchased some bone meal for manuring his paddy at the market price. These facts taken into consideration with what is stated under horn-shavings as a manure, make me think that, considering the peculiar climatic conditions under which agricultural operations are carried on in this country, we need not have much anxiety about the insolubility of manures.

Localities.	Plot number.	Manures applied per acre.		Prices of manures per acre.	Outturn per acre.	Money value of the outturn.	Remarks.
			lb	Rs. A. P.	lb	Rs. A. P.	
Ajhapur ...	1	Oil cake	240	6 15 0	2,880	36 0 0	
		Horn shaving	240				
Ditto ...	2	Oil-cake	120	3 12 0	3,600	45 0 0	
		Super	60				
Ajhapur	3	Oilcake	240	3 12 0	2,880	36 0 0	
,, ..	4	Oilcake	120	3 12 0	2,880	36 0 0	
		Super	60				
,, ..	5	Oilcake	200	3 2 0	3,600	45 0 0	
,,	6	Saltpetre	25	3 12 0	4,400	55 0 0	
		Oilcake	100				
,,	7	Super	60	3 12 0	2,400	30 0 0	
		Oilcake	120				
,,	8	Super	40	3 2 0	2,400	30 0 0	
		Oilcake	120				
Moynah	1	Oilcake	120	3 13 6	3,840	48 0 0	
		Super	60				
		Gypsum	18				
,, ...	2	Oilcake	120	3 8 0	3,840	48 0 0	
		Super	48				
		Gypsum	24				
,, ...	3	Super	120	6 7 3	2,100	26 4 0	
		Saltpetre	30				
		Gypsum	15				
,,	4	Oilcake	160	2 8 0	1,560	19 8 0	
,, ...		Bone ashes	210	5 12 0	1,680	21 0 0	
		Gypsum	36				
		Hide salt	24				
,,	6	Oilcake	120	3 13 6	1,920	24 0 0	
		Super	60				
		Gypsum	18				
,,	7	Oilcake	60	5 7 0	1,920	24 0 0	
		Super	60				
		Saltpetre	30				
Mashakram	1	Oilcake	120	11 6	2,400	30 0 0	
		Saltpetre	15				
		Steamed bone	60				
..	2	Hide salt	30	0 9 0	2,400	30 0 0	
..	3	Oilcake	120	5 5 6	2,401	31 0 0	
		Super	60				
		Saltpetre	15				
,, ...	4	Oilcake	120	3 6 0	3,120	39 0 0	
		Bone extract	90				
		Hide salt	30				
,, ..	5	Oilcake	120	3 12 0	3,120	39 0 0	
		Super	60				
		Saltpetre	15				
,,	6	Oilcake	120	3 12 0	2,040	25 8 0	
		Steamed bone	60				
		Hide salt	30				
,, ...	7	Oilcake	120	4 13 9	2,400	30 0 0	
		Steamed bone	60				
		Saltpetre	17				
,, ...		Oilcake	120	4 13 9	3,360	42 0	
		Steamed bone	60				
		Saltpetre	17				
,,	9	Bone extract ...	120	2 11 9	2,400	30 0 0	
		Hide salt	30				
		Gypsum	18				
,, ...	10	Super	120	6 9 3	2,160	27 0 0	
		Saltpetre	30				
		Gypsum	36				
Berh	1	Steamed bone ...	90	2 11 6	2,880	36 0 0	
		Hide salt	30				
		Gypsum	18				
,,	2	Super	120	6 8 0	3,600	45 0 0	
		Saltpetre ...	30				
		Gypsum	24				
Nabogram ...	1	Oilcake — ...	120	6 0 0	3,120	39	
		Super ...	60				
		Saltpetre ..	30				

Localities.	Plot number.	Manures applied per acre.		Prices of manures per acre.	Outturn per acre.	Money value of the outturn.	Remarks.
			lb	Rs. A. P.	lb	Rs. A. P.	
Nabogram	2	Oilcake	120	3 13 6	2,880	36 0 0	
		Super ...	60				
		Gypsum	18				
,,	3	Oilcake	120	3 3 3	1,440	18 0 0	
		Bone extract	60				
		Gypsum	36				
,,	4	Bone ashes	240	1 14 0	1,920	24 0 0	
		Hide salt	30				
		Gypsum	24				
Mushanda	1	Oilcake	120	3 12 0	3,600	45 0 0	
		Steamed bone	60				
		Hide salt	30				
Dheleri	1	Oilcake	120	3 2 0	2,400	30 0 0	
		Bone extract	60				
		Gypsum	24				
Maimari	1	Oilcake	240	3 12 0	1,440	18 0 0	
,,	2	Oilcake	120	4 8 0	1,440	18 0 0	
		Super	60				
		Hide salt	60				
,, ...	3	Oilcake.	120	3 9 6	3,840	48 0 0	
		Bone extract	60				
		Hide salt ...	48				
,,	4	Oilcake	240	3 12 0	Washed away by the flood,		
,,	5	Oilcake	120	3 9 6	Ditto	ditto.	
		Bone extract ...	60				
		Hide salt	48				
Kristapur	1	Oilcake	240	3 12 0	Ditto	ditto.	
,,	2	Oilcake	120	4 5 6	Ditto	ditto.	
		Super	60				
		Hide salt	48				
,,	3	Oilcake	240	3 12 0	.....	... ..	
,, ..	4	Oilcake	120	4 8 0	.....	...	
		Bone extract	60				
		Hide salt	48				
Ichhapur ...	1	Oilcake	120	4 2 0	2,880	36 0 0	
		Bone meal ...	60				
		Hide salt	60				
Kashiarah ...	1	Oilcake	120	3 15 6	1,488	18 9 6	
		Bone meal	60				
		Hide salt	48				
Bohar	1	Oilcake	120	4 8 0	2,880	36 0 0	
		Saltpetre	30				
,,	2	Oilcake	240	3 12 0	2,880	36 0 0	
,,	3	Oilcake	120	4 8 0	3,600	45 0 0	
		Saltpetre ...	30				
,,	4	Oilcake	120	5 6 0	.....		
		Saltpetre	4				
,,	5	Oilcake	120	2 4 0	2,400	30 0 0	
		Hide salt ...	30				
Minapur ...	1	Oilcake	120	2 4 0	1,280	16 0 0	
		Hide salt	30				
Jakrah	1	Oilcake	240	3 12 0	3,360	42 0 0	
,,	2	Oilcake	120	4 8 0	2,160	27 0 0	
		Saltpetre ...	30				
,,	3	Oilcake ..	240	3 12 0	2,880	36 0 0	
,,	4	Oilcake ...	120	4 8 0	2,400	30 0 0	
		Saltpetre ...	30				
Hatsimul	1	Oilcake	240	0 11 0	2,880	36 0 0	
		Saltpetre	30				
,,	2	Oilcake	240	4 2 0	2,880	36 0 0	
		Hide salt	30				
,, ..	3	Saltpetre	60	5 10 0	2,880	36 0 0	
	4	Hide salt ...	60	0 15 0	2,880	36 0 0	
		Saltpetre ...	24				
Ichhabazar	1	Super ...	24	4 3 0	2,880	36 0 0	
		Hide salt	24				

2.—*Sugarcane.*

Sugarcane planting had been over three or four months before I joined my present appointment. Consequently it was not possible to try any systematic experiments on sugarcane. Rather however than wait about nine months before trying any experiments on this crop, I thought it better to try a few manures as top-dressings. Here my difficulty in inducing the ryots to undertake these experiments was even greater than in the case of paddy. I was allowed to experiment only on the worst portions of the field and on plants which were almost dead. The effects of the manures used were really astonishing. The manures were applied at the end of Sravan, and by the beginning of Aswin the plants whose growth had almost stopped came up to the height of the very best plants of the field. Unfortunately, partly from wilful negligence on the part of the ryots, and partly from the peculiar conditions under which these experiments were made, it has not been found possible to obtain any quantitative results. The ryots, however, have been thoroughly convinced of the efficiency of these manures. They told me repeatedly that no manure hitherto known to them could have produced any thing like as good results by top-dressing as the manures given on the next page.

I may here mention that I have already commenced a series of experiments on sugar-cane in the Burdwan experimental station as well as in four Government villages in the Hooghly district, in order to ascertain the manure, mode of culture, and variety best suited to this important crop.

Localities.	Plot number.	Manures applied per acre.		Prices of manures per acre.	Outturn per acre.	Money values of the outturn.	Remarks.
			lb	Rs. A. P.			
Hatsimul ...		Oilcake	960	15 0 0	.....	.....	
" ..	2	Oilcake	480	15 0 0	.....	.....	
		Super	240				
" ..	3	Gypsum ... " ...	72	9 7 3	.....	.....	
		Hide salt	120				
		Super	240				
" ..	4	Gypsum	72	13 9 3	.....	.....	
		Super	240				
		Saltpetre	60				
Ajhapur	1	Super ... " ...	240	13 9 3	.. ...	.....	
		Saltpetre	60				
		Gypsum	72				
" ...	2	Super	240	13 9 3	.....	.. ...	
		Saltpetre	60				
		Gypsum	72				
"	3	Oilcake	960	15 0 0	.. ...	.....	
"	4	Oilcake	480	15 0 0	.....	.....	
		Super	240				
"	5	Oilcake	480	15 0 0	.....	.....	
		Super	240				
Mashagram	1	Gypsum	80	13 5 0	.....	.....	
		Super	240				
		Saltpetre	60				
.. ..	2	Gypsum	80	13 5 0	.....	.....	
		Super	240				
		Saltpetre	60				

3.—*Potatoes.*

The results of the manure experiments with potatoes have been very disappointing to me. These experiments were arranged with great care, and I was almost certain of their success Unfortunately, in most of the villages in which experiments were tried, the plants were attacked by a disease known as *dhasa* among the ryots. The plants were prematurely destroyed, and the outturn in every instance was far below the average. One peculiarity of this disease ought to be mentioned here. In almost every instance the powerful manures which were given to the ryots made the plants treated with them at first grow a good deal more luxuriantly than others to which the ordinary manures of dung and oil-cake were applied, but these luxuriant plants suffered most from the disease. This the potato-growers of Europe know to be a peculiarity with blight.

In places where the crop did not suffer from this terrible disease very fair results have been obtained. From enquiries made by me at some of the most important potato-growing villages in the division, it appears that however much the quality as well as the quantity of the outturn may be influenced by the nature of the soil, by the manures applied, the mode of culture adopted, and the climatic conditions of the locality, the factor on which the success of potato cultivation is most dependent is the nature of the seed used.

Potato experiments in Government villages.

Localities.	Plot No.	Manures applied per acre.		Price of manures per acre.	Outturn per acre.	Money values of the outturn.	Remarks.
				Rs. A. P.	lb	Rs. A. P.	
Belcooly ...	1	Dung	533 chupris.	33 5 4	10,667	160 10 6	
" ...	2	Oilcake	2,134 lbs.	33 5 6	12,800	200 0 0	
" ...	3	Super	160 "	39 10 9	13,867	216 10 6	
		Bone meal	373 "				
		Saltpetre	267 "				
" ...	4	Oilcake	800 "	48 13 0	16,000	250 0 0	
		Super	134 "				
		Bone meal	267 "				
		Saltpetre	267 "				
Nabina ...	1	Dung	533 chupris.	33 5 4	5,333	83 5 0	
" ...	2	Oilcake	2,134 lbs.	33 5 6	7,467	116 10 6	
" ...	3	Super	160 "	39 10 0	8,533	133 5 6	
		Bone meal	373 "				
		Saltpetre	267 "				
" ...	4	Oilcake	800 "	48 13 0	10,667	166 10 6	
		Super	134 "				
		Bone meal	267 "				
		Saltpetre	267 "				
Mozupur ...	1	Dung	533 chupris.	33 5 4	7,467	116 10 6	
"	2	Oilcake	2,134 lbs.	33 5 6	6,400	100 0 0	
"	3	Super	160 "	39 10 9	9,600	150 0 0	
		Bone meal	273 "				
		Saltpetre	267 "				
" ...	4	Oilcake ...	800 "	48 13 0	8,533	33 5 0	
		Super	134 "				
		Bone meal	267 "				
		Saltpetre	267 "				

Potato experiments in other villages.

Localities.	Plot number.	Manures applied per acre.		Prices of manures per acre.	Outturn per acre.	Money values of the outturn.	Remarks.
			lb.	Rs. A. P.	lb	Rs. A. P.	
Panchra	1	Super	168	29 8 0	9,600	135 0 0	
		Bone meal	336				
		Saltpetre	180				
Ajhapur	1	Oilcake	1,440	22 8 0	10,560	148 8 0	
,,	2	Ditto	960	37 12 0	13,440	189 0 0	
		Bone extract	672				
		Ashes	480				
,,	3	Oilcake	960	1 0 0	11,520	162 0 0	
,,	4	Ditto	960	47 6 0	11,520	162 0 0	
		Bone extract	336				
		Bone meal	240				
		Saltpetre	180				
,,	5	Oilcake	960	15 0 0	10,560	148 8 0	
,,	6	Ditt	960	51 0 0	13,440	189 0 0	
		Bone meal	480				
		Saltpetre	240				
,,	7	Oilcake	1,440	22 8 0	11,520	162. 0 0	
,,	8	Saltpetre	180	28 10 0	11,520	162 0 0	
		Super	144				
		Bone meal	288				
,,	9	Oilcake	1,440	22 8 0	4,800	67 8 0	
,,	10	Oilcake	960	48 0 0	4,800	67 8 0	
		Bone meal	600				
		Saltpetre	180				
Moynah	1	Oilcake	720	37 4 0	7,680	108 0 0	
		Bone extract	624				
		Saltpetre	120				
,,	2	Oilcake	1,920	30 0 0	7,680	108 0 0	
,,	3	Super	480	35 4 0	6,720	94 8 0	
		Saltpetre	180				
		Gypsum	360				
,,	4	Oilcake	720	26 4 0	4,800	67 8 0	
		Bone extract	480				
		Ashes	240				
,,	5	Oilcake*	720	29 4 0	4,800	67 8 0	
		Bone meal	600				
		Ashes	240				
Jajanpur	1	Oilcake	720	44 4 0	4,800	67 8 0	
		Bone extract	600				
		Saltpetre	180				
Bohar	1	Oilcake	1,920	30 0 0	7,680	108 0 0	
,,	2	Super	480	39 12 0	6,720	94 8 0	
		Saltpet	240				
		Gypsum	360				
,,	3	Oilcake	1,584	24 0 0	7,680	108 0 0	
,,	4	Oilcake	720	27 12 0	2,880	40 8 0	
		Bone extract	540				
		Ashes	240				
,,	5	Oilcake	1,920	30 0 0	7,680	108 0 0	
,,	6	Oilcake	720	51 12 0	5,760	81 0 0	
		Super	480				
		Saltpetre	240				
		Ashes	240				
,,	7	Oilcake	2,400	37 8 0	7,680	108 0 0	
,,	8	Oilcake	720	40 8 0	6,720	94 8 0	
		Bone extract	600				
		Ashes	240				
		Saltpetre	120				
,,	9	Oilcake	1,920	30 0 0	7,680	108 0 0	
,,	10	Oilcake	720	45 12 0	6,720	94 8 0	
		Bone meal	480				
		Saltpetre	240				
,,	11	Oilcake	1,920	30 0 0	7,680	108 0 0	
,,	12	Oilcake	720	29 0 0	2,400	33 12 0	
		Bonemeal	480				
		Ashes	480				
,,	13	Oilcake	1,680	26 4 0	3,840	54 0 0	
,,	14	Oilcake	720	26 4 0	2,880	40 8 0	
		Bone meal	480				
		Ashes	240				
,,	15	Super	120	19 2 0	4,800	67 8 0	
		Bone meal	120				
		Saltpetre	120				
		Gypsum	180				
,,	16	Oilcake	960	27 12 0	3,600	50 10 0	
		Bone meal	390				
		Ashes	240				
,,	17	Oilcake	1,920	30 0 0	3,600	50 10 0	
Sidhara	1	Oilcake	1,584	24 11 0	4,800	67 8 0	
,,	2	Oilcake	720	26 4 0	4,320	60 12 0	
		Bone meal	480				
		Ashes	240				
Magra	1	Oilcake	1,920	30 0 0	3,840	54 0 0	
		Ashes	720				
,,	2	Super	156	27 15 0	1,056	14 14 0	
		Bone meal	312				
		Saltpetre	240				
		Ashes	96				
,,	3	Oilcake	2,472	38 10 0	3,840	54 5 0	
,,		Oilcake	720	51 12 0	4,320	60 12 0	
		Bone meal	480				
		Saltpetre	240				
		Ashes	480				
Tikipur	1	Oilcake	1,920	30 0 0	5,760	81 0 0	
,,	2	Oilcake	720	51 12 0	2,880	40 8 0	
		Bone meal	480				
		Saltpetre	240				
		Gypsum	480				
Kashipur	1	Oilcake	1,920	30 0 0	5,760	81 0 0	
,,	2	Oilcake	720	48 0 0	5,760	81 0 0	
		Bone meal	480				
		Saltpetre	240				
		Gypsum	360				
Bhaleri	1	Super	144	29 12 0	4,800	67 8 0	
		Bone meal	288				
		Saltpetre	180				
Tangaberia.	1	Saltpetre	180	31 0 0	4,800	67 8 0	
		Super	144				
		Bone extract	336				
,,	2	Super	480	35 4 0	4,800	67 8 0	
		Saltpetre	180				
		Gypsum	360				

Localities.	Plot number.	Manures applied per acre.		Prices of manures per acre.	Outturn per acre.	Money values of the outturn.	Remarks.
			lb	Rs. A. P.	lb	Rs. A. P.	
Mashagram ...	1	Oil-cake	960	15 0 0	6,240	87 12 0	
,, ...	2	Oil-cake	960	49 8 0	6,832	96 8 0	
		Bone meal	240				
		Bone extract	240				
		Saltpetre	240				
,, ...	3	Oil-cake	2,880	45 0 0	5,760	81 0 0	
,, ...	4	Oil-cake	960	36 0 0	6,720	94 8 0	
		Bone extract	720				
		Ashes	240				
,, ...	5	Oil-cake	600	9 6 0	4,800	67 8 0	
,, ,,	6	Oil-cake	600	34 2 0	4,800	67 8 0	
		Bone meal	240				
		Super	120				
		Saltpetre	150				
,, ...	7	Oil-cake	1,800	28 2 0	2,910	40 15 0	
,, ...	8	Oil-cake	900	32 1 0	3,060	43 0 6	
		Bone extract	600				
		Ashes	240				
,, ...	9	Oil-cake	1,920	30 0 0	3,840	54 0 0	
,, ...	10	Super	148	25 0 0	3,840	54 0 0	
		Bone extract	336				
		Saltpetre	120				
,, ...	11	Super	480	35 0 0	4,800	67 0 0	
		Saltpetre	180				
		Gypsum	360				
Maimaree ...	1	Bone meal	480	35 0 0	5,760	81 0 0	
		Oil-cake	720				
		Saltpetre	120				

4.—*Miscellaneous.*

Small quantities of seed of a number of new crops or of new varieties of crops already under cultivation were distributed in over 40 villages, in order to see in a general way what chance they have of being added to the farm crops of the division. The statement below gives an abstract of the opinions of the ryots of the villages in question as to the results :—

Names of villages.	Buxar wheat.	Cape oats.	White linseed.	Shahabad gram.
Kalurtack	Can be grown with success.	Can be grown with success.	Can be grown with success.	Can be grown with success.
Lischindepara ...	Gives a better outturn than the local variety.	Ditto ...	Ditto ...	Ditto.
Bonpara	Can be grown with success.	Gives a better outturn than the local variety.	Gives a better outturn than the local variety.	Not better than the local variety.
Mangakot	Ditto ...	Ditto ...	Ditto ...	Ditto.
Barabazar	Not better than the local variety.	Ditto ...	Ditto ...	Ditto.
Kogram	Gives a better outturn than the local variety.	Ditto ...	Ditto ...	Gives a better outturn than the local variety.
Pratappur	Ditto ...	Not better than the local variety.	Not better than the local variety.	Not better than the local variety.
Natunhat	Could be grown with success.	Could be grown with success.	Could be grown with success.	Could be grown with success.
Nauhat	Ditto ...	Not better than local variety.	Not better than local variety.	Gives a better outturn than the local variety.
Jaggeswardihi ...	Not better than local variety.	Ditto ...	Ditto ...	Ditto.
Agradwip	Gives a better outturn than the local variety.	Gives a better outturn than the local variety.	Gives a better outturn than the local variety.	Could be grown with success.
Patun	Not better than the local variety.	Not better than the local variety.	Not better than the local variety.	Gives a better outturn than the local variety.
Cutwa	Ditto ...	Gives a better outturn than the local variety.	Ditto ...	Ditto.
Shambazar	Ditto ...	Ditto ...	Could be grown with success	Not better than local variety.
Sagira	Ditto ...	Could be grown with success.	Not better than the local variety.	Worse than the local variety.
Tikuri	Gives a better outturn than the local variety.	Gives a better outturn than the local variety.	Ditto ...	Ditto.
Sazram	Not better than local variety.	Not better than local variety.	Ditto ...	Ditto.
Balindar	Ditto ...	Ditto ...	Ditto ...	Ditto.
Gramkalna	Ditto ...	Gives a better outturn than the local variety.	Gives a better outturn than the local variety.	Gives a better outturn than the local variety.
Madgachhi	Ditto ...	Not better than local variety.	Not better than local variety.	Could be grown with success.
Sikapur	Gives a better outturn than the local variety.	Ditto	Ditto	Gives a better outturn than the local variety.
Gupinpur	Ditto	Ditto	Ditto	Worse than the local variety.
Pearibagan	Not better than the local variety	Gives a better outturn than the local variety.	Gives a better outturn than the local variety.	Gives a better outturn than the local variety.
Bhabanipur	Gives a better outturn than the local variety.	Ditto	Could be grown with success.	Worse than the local variety.
Mathoy	Ditto	Not better than local variety.	Not better than local variety.	Ditto.
Badagachi	Not better than the local variety.	Ditto	Ditto	Ditto.
Chandipur	Ditto	Ditto	Ditto	Ditto.
Nandagram	Gives a better outturn than local variety.	Gives a better outturn than local variety.	Could be grown with success.	Gives a better outturn than the local variety.
Kaldan a	Not better than local variety.	Not better than local variety.	Gives a better outturn than local variety.	Not better than local variety.
Bhoorkunda	Gives a better outturn than local variety.	Gives a better outturn than local variety.	Ditto	Could be grown with success.
Machar	Could be grown with success.	Ditto	Could be grown with success.	Ditto.
Kristadebpur ...	Ditto	Ditto	Ditto	Ditto.
Dharmadanga ..	Gives a better outturn than local variety.	Ditto	Ditto	Gives a better outturn than local variety.
Ambika	Ditto	Ditto	Ditto	Not better than local variety.

Names of villages.	Sugar wheat.	Cape oats	White linseed.	Shahabad gram.
Kalna	Gives a better outturn than local variety.	Could be grown with success.	Could be grown with success	Could be grown with success.
Charakdanga ..	Ditto	Gives a better outturn than local variety.	Ditto ..	Gives a better outturn than local variety.
Korapokur .	Could be grown with success	Ditto ..	Ditto	Ditto
Shampur	Gives a better outturn than local variety.	Ditto .	Gives a better outturn than local variety.	Could be grown with success.
Laldanga	Ditto	Ditto .	Could be grown with success.	Ditto.
Kannangra ..	Ditto	Ditto	Ditto ..	Ditto
Narayanpur .	Ditto	Ditto	Ditto	Ditto
Kodalah .	Could be grown with success.	Could be grown with success.	Ditto ...	Gives a better outturn than local variety
Moozpur	Ditto			
Nabina , ...	Ditto ...			
Peasarah	Ditto		...	..
Pearapur ,	Ditto ..			...
Barrakar	Ditto	Could be grown with success.		.
Patrasair	Ditto	.	.. ...	

English potatoes.

The cultivation of English and Darjeeling potatoes was tried in the following villages with the results noted below :—

Locality.	Remarks.
Bamshare	Outturn, 8 fold, Quantity used as seed.
Kalurtak	Failed.
Natunhat	Outturn, 10 fold. "
Jageswarduli	Ditto.
Shambazar	Outturn, 8 fold. "
Pearibagan	Outturn, 10 fold. "
Bhabanipur	Outturn, 12 fold. "
Machhar	Outturn, 10 fold. "
Kristadebpur	Outturn, 14 fold. "
Ambika	Outturn, 16 fold. "
Kodalia	Outturn, 14 fold. "
Moynah	Outturn, 5½ fold. "
Belcooli	Outturn 10 fold.
Moozpur	Can be grown with success.
Pearapur	Outturn, 8 fold.
Patrasair	Hitherto potatoes were not grown. Can be grown with success.
Barrakar	Hitherto potatoes were not grown. Can be grown with great success.
Mashagram	Better than the local variety.
Ajhapur	Ditto ditto.
Bohar	Ditto ditto.
Burdwan Farm	Outturn, 8 folds
Burdwan, Beerhatta	Not better than local variety.
Darjeeling.	
Burdwan farm	Outturn, 6 fold. Quantity used for seed.
Barrakar	Failed.
Mashagram	Yield not better than local variety.
Tangabaria	Ditto ditto
Panchra	Better than local variety

The result of introducing English potatoes and distributing them among some ryots in these villages is that applications have been made to me for the purchase of 50 more maunds for seed by ryots and talukdars.

PART III.

Chapter IV—SUGGESTIONS

1—*Paddy.*

1. Very little can be suggested for the improvement of the cultivation of paddy which has been so long under cultivation in Bengal, and grown under such varied conditions, that, taking the country as a whole, the ryots' knowledge regarding this important crop has attained a degree of perfection

almost unprecedented in the history of agriculture. But the ryots of one district have much to learn from their brethren in other districts. As regards the use of manures, for example, no substantial ryot of Burdwan would willingly grow his paddy without applying some dung or oil-cake to the field, and this liberal treatment is always attended with an increased outturn; while in other districts neither dung, oil-cake or any other manure is applied to this crop. The fact that oil-cake is a highly remunerative manure as applied to paddy, and that it is so largely used in the Burdwan division, I think deserves to be known far and wide. The general opinion that, unlike other crops, paddy requires no manuring is, I think, not based on fact. It may be a fact that lands which are renovated by a yearly deposit of silt do not need to be manured, but this is as true of other crops as of paddy. The extent of such lands which do not require manure has been much exaggerated. As regards the particular manures to be used, dung, if available in sufficient quantity, would no doubt be the best fertilizer to apply. Oil-cake is also good, but its effect does not last for more than a year. Of the so-called artificial manures, bones somewhat coarsely ground I consider the best. This manure should be applied at the time of ploughing in March or April, and at the rate of one maund per bigha. I have no faith in the continued application of such manure as hide salt, saltpetre, &c., when applied alone, but bones and saltpetre mixed together would be valuable not only for paddy, but for almost any crop. Wood-ashes, or ashes of rice husks, might be substituted for saltpetre in the above mixture. If both bones and saltpetre are to be used, the best plan would be to apply about half a maund of bone-meal per bigha when the land is being ploughed, and when the plants are in a somewhat forward condition to top-dress them with about five seers of saltpetre reduced to as fine a powder as possible, and mixed with three times its weight of dry earth.

2. The *amun* lands are often much neglected. They are seldom ploughed in summer so as to have the soil well weathered and sweetened. As a consequence, organic acids accumulate in these unploughed fields, and when in the rainy season after two or three ploughings the rice seedlings are planted in the mud, they fail to strike root. The ryots, not knowing the real cause of the failure, ascribe it to a disease in the plant known to them by the name of *kadamara*. They try to remedy this by spreading over the field a few seers of hide salt and turning it over by the *kodali*. This, as might be foreseen, proves to be only a temporary remedy. The organic acids are brought to the surface, but instead of being destroyed by the action of the air and sun, as they would have been had the soil been inverted during the summer, are dissolved by the rains, and again taken to the deeper layers of the soil. These lands in which there is an excess of organic acids should therefore be ploughed in summer, or, better still, as soon as the harvest crops have been removed. The ploughing, if possible, should be given with an inverting plough.

3. It has been pointed out elsewhere that these *amun* lands form over 80 per cent. of the whole area under cultivation. It has also been shown that even if all the farmyard manure of the country could be collected without any waste and spread most economically over the cultivated area, it would still fall far short of the requirements. To make up the deficiency by the use of artificial manures is simply an impossibility. One way which has been suggested for recouping cultivated fields which suffer by cropping is to make use of night-soil as a manure. It will, however, be a long time before night-soil would be largely used in a country like Bengal. Not only have we to deal with the prejudices and feelings of the people, but there is the most important question of sanitation yet to solve. Under such circumstances there can be no doubt that it would be a great gain if green manuring could be largely practised on *amun* paddy lands, saving all the farmyard manure for the *aus* lands. The best treatment the *amun* land could receive would be something like this: as soon as possible after the paddy has been harvested, the land should be ploughed with an inverting plough, or ploughed and cross-ploughed with the country implement. The land should receive one more ploughing some time in Chaitra. As early as possible in the month of Baisakh, seeds of indigo or *dhaincha* should be sown broadcast. In Ashar the indigo or the *dhaincha* plants should be mixed up with the soil, if the land be sufficiently dry, with the inverting plough, otherwise with the country plough. In

both cases it would be better to use the ladder twice before ploughing in, the plants. About a fortnight after two ploughings should be given in the mud, and then waiting a day or two the paddy seedlings should be transplanted.

It will be noticed that here, as throughout this report, I have drawn a great distinction between the lowlying *amun* lands and the comparatively high lands on which *aus* paddy is grown. Green manuring no doubt would prove equally beneficial to both *aus* and *amun* lands—indeed in the light soil of the former its results might be even more striking. But it would be very advantageous if green manuring were generally practised in all *amun* lands. There is hardly any time to prepare the land for sowing indigo or *dhaincha* early in Baisakh in *aus* land. Again, *aus* paddy requires to be planted one month earlier than *amun* paddy. In the one case we have; and in the other we have not, the time necessary for the proper growth of indigo and *dhaincha* and mixing them with the soil. Green manuring is therefore possible on *aus* lands only under special conditions.

4. Originally an aquatic or marshy plant paddy requires a large quantity of water for its successful cultivation. This makes the ryots sometimes commit the serious mistake of allowing water to stagnate in the paddy fields. When this is done, the fields are infected with swarms of insects, sometimes destroying the entire crop. Stagnant water, therefore, should as much as possible be avoided. More economy in using water is also desirable in places where an abundant supply of canal water being available, the ryots become careless regarding the amount of water they put in their fields.

2.—*Sugarcane.*

Sugarcane, like all crops propagated solely by buds, will, if grown continuously under the same conditions of soil and climate, get deteriorated in quality. It is therefore necessary that new varieties should from time to time be introduced from foreign countries as well as from distant parts of the same country. The variety of cane known as the Bombay was some years ago very extensively grown in the eastern parts of the Burdwan and the Hooghly districts. After a time it began to shew signs of disease, and then a kind of blight made its appearance and destroyed the produce of hundreds of cane fields. The ryots got alarmed and ceased to plant this variety of cane. This was some fifteen years ago. Since then the variety of cane mostly grown is that known as *shamshara*. It is a very superior variety, well suited to low-lying places Cases, however, have come to my notice shewing that some plants of this variety of cane also have been similarly attacked. This disease, making its appearance near Howrah, with probably extend westward and southward. It is therefore time to import same good varieties of cane from other parts of India as well as from other cane-growing countries. The following varieties named and described in the Sugar Growing and Refining by Lock, Wigner and Harland, may be imported and their cuttings distributed among ryots of some of the imported sugar-growing villages; or, what would be a better plan, these may at first be planted in an experimental farm and the distribution may begin the next year:—

1.	Assam	... Red cane.	8.	Batavia	... Purple violet.
2.	Nepal	... Yellow cane.	9.	Straits Settlement	Tibho Caffir.
3.	Do.	... Black cane.	10.	Society Islands	Ribbon.
4.	Otaheite	... Purple striped or Ribbon.	11 and 12.	Trinidad	Nos. 13 and 14 in Preston's list (for fodder).
5.	Do.	... Yellow.			
6.	Batavia	... Ribbon.	13.	Do.	... Caledonian queen.
7.	Do.	... Yellow.			

I may here remark that attempts to substitute sorghum for sugarcane as a sugar-producing plant have not, in my opinion, the least chance of success. As a sugar-producing plant, sugarcane is incomparably superior to sorghum. But as a fodder crop, sorghum stands very high. It produces a large quantity of nutritious food for cattle at a time when paddy straw—the only fodder now in use in Bengal—is most scarce. For this reason the general introduction of this crop in this country as a fodder crop is very desirable.

2. Whatever difference of opinion there might be with regard to the advantages of deep cultivation in case of paddy, no one will deny that, for the successful cultivation of sugarcane, it is absolutely necessary that the soil should be stirred to a great depth. For doing this the ryot's plough is quite inefficient. The *kodali* is better for this purpose than any implement yet invented, with the single exception purhaps of the steam digger, but digging with the *kodali* is an exceedingly expensive process. A cheap, simple, and efficient subsoiler is therefore a great desideratum.

3. The mode of planting cane followed in Bengal, though not so bad as sometimes represented, is not the best that might be adopted. The Mauritius system of planting canes in holes at regular intervals is not unknown in Bengal. It is the system followed by all market gardeners, but is not suited to field cultivation and is very expensive. In the Burdwan experimental station, I have been trying a mode of planting which is a modification of that proposed by Mr. Burrows Beheea. It is well suited to the mode of irrigating cane fields followed in the Burdwan Division, and is not expensive, and it will also to some extent obviate the drawbacks arising from the ryots not possessing a sub-soiler and may be described thus. After the land has been well-stirred to a depth of at least 9 inches and thoroughly pulverised, it should be levelled with the ladder. The field is first divided into a number of small plots by water channels drawn up and down as well as across it. By means of the *kodali* now make parallel channels, at intervals of 27 inches. These channels should be deep enough to raise most of the earth that was stirred by the plough. The manure to be applied, generally oil-cake finely powdered, is then spread in these channels. Then taking a *kodali*, invert the soil in the bottom of these channels, striking as deep and as close as possible. Any clods raised should be broken and mixed with the manure. Keep the soil thus inverted, exposed to air and sun for about a fortnight. When planting the canes, pour water on the channels and fix the sets firmly into the mud. The sets should be placed along and not across the channels, for if the latter plan be adopted it will interfere with subsequent operations. The sets are covered with only a small portion of the earth raised, but they should be placed deep enough to keep them cool.

4. The sets are often much injured by white ants, the damage done by these insects being sometimes so great that there are localities where cane-planting has become an impossibility in consequence. It is very necessary to make systematic experiments with a view to find out the best remedy or remedies. Of phospha-guano Mr. Benson writes:—" It has been ascertained that the manure is very efficacious as an application for preventing sugarcane cuttings from being attacked by white ants, and must be remembered that it at the same time affords the food needed by sugarcane during its growth." Phospha-guano, however, is not unfortunately procurable in this country, but the following substances may be tried: (1) kerosine oil mixed with water; (2) gas tar diluted with water; (3) water in which *neem* leaves have been boiled.

5. The boiling of cane juice is a very cumbrous operation as done in most parts of the division. The substitution of the earthen pots by Shahabad pans or those as modified by Mr. Mylne of Beheea would be a great improvement. The Shahabad and the Burdwan ryots have much to learn from one another in the cultivation of sugarcane and the boiling of the juice into *gur* as well as in sugar-refining, the mode of sugarcane cultivation in Burdwan being much superior to that in Shhabad, while the Burdwan ryots are much behind their brethren in Shahabad, both in *gur*-making and sugar-refining.

6. The Beheea mills have not proved quite a success in the Burdwan Division, the price demanded for these mills, though not unreasonable, being beyond the means of most of the Burdwan ryots, so that a cheap and efficient sugarcane mill for the Burdwan Division is still a desideratum.

7. Sugarcane fields are very liberally manured here. About 10 maunds of oil-cake are applied to every bigha of sugarcane. Some phosphatic manure added to the oil-cake would be a great improvement. Instead of 10 maunds of oil-cake I would recommend a mixture of oil-cake and 2½ maunds of bone meal; 2½ maunds of oil-cake together with as much bone meal should be applied at the time of planting the canes in the way described in paragraph 3. The remaining portion of the oil-cake should be applied as a top-dressing in Sravan

3.—*Potatoes.*

Potatoes are very largely grown in Burdwan and Hooghly but few have any idea as to how inferior the kind of seeds generally used is It will be no exaggeration to say that over fifty per cent. of the cultivators use as seed diseased potatoes which an English farmer would not think of using for seed. This neglect to procure good seed entails great loss. In considering this subject we should remember that potatoes are propagated not from seeds, but from buds, and bud propagation has the peculiarity that the offspring are almost the counterparts of their parents, so that it is quite hopeless to expect good potatoes from bad seed.

Lower Bengal and its climate are not particularly suited to potato-growing, and if good sound potatoes are to be produced, it is all the more necessary that the seed (so called) should be changed at short intervals, say every third year. The best way to effect this that I can think of is to start a Government farm somewhere near Darjeeling—a place somewhat lower down would be preferable—to raise good and sound potatoes of the best varieties, and sell them to the potato-growers of Bengal and Behar. From the numerous applications that have been made to me for Darjeeling and English potatoes grown at the Burdwan experimental farm, I am certain that such a farm would prove a financial success.

Seed can be procured from the Revd Mr. Wilson of Rangaroon.
M F.

2. As in case of sugarcane, a sub-soiler would prove a great help to the potato-growers.

3. Potato fields are very liberally manured, and for this, as for sugarcane and cabbages, oil-cake is largely used. An addition of wood-ashes and some phosphatic manures would greatly increase the value of the oil-cake. Cowdung, unless very old and well rotten, should not be applied to potato fields. Very goods potatoes have been grown at the experimental farm at Burdwan with Ville's manures.

4. If well-sized entire potatoes cannot be had, cut sets may be used, each containing only one good eye. I think the sets need not be large. If a number of plants come out in one place owing to the sets containing several eyes each, the field should be carefully thinned.

5. The rows should not be made more than 22 inches apart. Narrow-bladed *kodalis* should be used in earthing up the plants.

4.—*Wheat.*

1. From the results of experiments made at the Burdwan Farm as well as in a number of villages in Hooghly and Burdwan, I think this valuable cereal could be grown in many places in this division, where its cultivation now is almost unknown.

2. The white wheat with a slight brownish tint grown in the dearah land north of Arrah, and which is known in the Calcutta markets as Club No. 1, may with great advantage be used for seed in this division also.

3. A small quantity of saltpetre if applied as a top dressing when the plants are about eight or nine inches high would greatly increase the yield. Hide salt may serve the same purpose at a much less cost. But I am not at all in favour of the use of special manures alone. My recommendation is to apply some 20 bags of dung or a maund of bone meal per bigha when ploughing the land for wheat, and when the plants are in a somewhat forward state, to top-dress them with five seers of saltpetre. Pond mud, when available, would prove a very good fertilizer.

5.—*Gram.*

1. Seed may be imported from Shahabad.
2. A maund of bone meal per bigha will greatly increase the outturn.

6.—CABBAGES.

The following mixture, I think, will give a good crop of cabbages :—

Bone meal	...	3 maunds.	Saltpetre	...	1 maund.
Oil-cake	...	3 "	Hide salt	...	1 "

7.—*Fodder.*

1. Under the head of increasing the area of grazing lands in the division, I can only repeat what I wrote in my letter No. 77, dated the 4th February 1886, to the Director:—"The only practical suggestion I can offer on the subject is to preserve as fodder and fuel reserves all those chara land that came into the possession of the Government under Regulation XI of 1825 and Act IX of 1847. These lands if not broken for cultivation will in a few years grow very large quantities of grass."

2. Elsewhere I have pointed out the wastefulness of the practice of permitting the cattle to enter into the grazing lands and grass fields at any time of the year without any restraint. The most successful way to prevent this would be to enclose the grazing grounds by thorn hedges and divide them into a number of plots, allowing the cattle to graze them, one after another, so that when one plot is being depastured the others may be at rest. When fencing is not possible, if there be two or more grazing grounds in different parts of the village, they should be treated as so many enclosed plots.

Impracticable.
M. F.

3. Ryots disposed to grow any crop specially intended for fodder for the cattle may try any of the following :—

(1) Sorghum.
(2) Yellow cholum (Madras).
(3) Dedhan (Joar).
(4) Maize.
(5) Reana luxurias.

The first, second and the fifth will give two crops a year.

For milk cows, sugar beet, mangold, and cabbages may be grown with advantage, as is shown by results of experimental cultivation of these crops in the Burdwan farm.

2.—*Live stock.*

1. To provide the ryots with better working bullocks and milking cows, I am disposed rather to look to the breed indigenous to the country than to import from foreign lands or other parts of India; selection and better feeding are likely to meet with greater success than importing animals new to the peculiar climatic conditions of Bengal. The indigenous breed, whatever its faults may be, is exceedingly hardy, and considering the small quantity of food it consumes, the amount of work obtained is astonishing.

But the improvement of the live stock is very greatly dependent on a proper supply of fodder, and unless this can be increased or the quality improved, we cannot hope for much success in this direction.

3.—*Collection of Information.*

Experiments.

In the resolution of the Government of Bengal announcing the creation of the Agricultural Department, great stress was laid on agricultural enquiries and collection of agricultural facts. That this is the most important duty of the various Agricultural Departments of India was also very distinctly stated in the letter of the Secretary of State to the Government of India dated June 1881. The resolution of the Government of India dated December 1881 is equally pronounced on this point. The improvement of the agriculture of the country is no doubt one of the ultimate objects aimed at by the Agricultural Department, but this is only possible after we have put ourselves in possession of an accurate knowledge of all important agricultural facts and have got a real insight into the rural economy of the country. Before we can expect to make any improvement in the existing system of agriculture, we must know accurately what that system is.

The facts to be collected may be put under two different heads, and though they are very much related to one another, the agencies and means needed for their systematic collection are not the same. Under the first head come such facts as may be expressed by the term agricultural statistics, and under the

second head may be put together all information relating to purely agricultural operations, cultivation of crops, and rearing and management of live stock.

For the collection of agricultural statistics we have no agency in Bengal. The first step towards its realization is no doubt a cadastral survey of the country, and this has been barely commenced.

For the collection of the other class of information, a much smaller number of men will suffice; but the task is no less a difficult one. Here what is wanted is not only to make a complete, accurate and a systematic collection of all agricultural operations done in the country, but a body of agricultural officers having a real insight into, and a practical knowledge of, the Indian systems of agriculture; for it is with the aid of such men only that the collection of agricultural facts can be made proper use of. It is necessary that these officers should have as much practical knowledge of Indian agriculture as is possessed by the cleverest and most experienced of the ryots. They must not neglect even the mere manual part of the work. They must be able to make as good a furrow and to strike the *kodali* with as much skill as any of the ryots. Such practical knowledge no doubt will be very difficult to acquire; but such men only are worthy of being called specialists in agriculture who can give sound common-sense advice to the Government on all agricultural matters. That they must have a thorough knowledge of the general principles and the science of agriculture goes without saying. If this is what is meant by agricultural enquiries, it is obvious such enquiries cannot be properly made by any amount of travelling through the country, nor by the most careful observation of what is done by the ryots. Nor can this kind of knowledge be acquired by any amount of questions put to the Indian peasants, or by trying to decipher their almost unintelligible answers. To learn any branch of physical science one must work at the laboratory, and the only way to learn practical agriculture is to work in the field.

Agricultural experiments.

After we have obtained an accurate knowledge of the existing systems of agriculture, our next efforts should be directed towards making a series of systematic experiments well devised and performed with on the accuracy physical science is capable of. So far as pure experiments go, the plan that has been matured for the United Provinces and Oudh appears to me to be the most reasonable one. There should be a central farm under able management to carry on all important agricultural experiments. The success of such a farm should be measured by the accuracy with which the experiments are conducted and by the nature of these experiments. Except with regard to some special experiments, profit should be only a secondary consideration on such a farm. But the Government farm at Cawnpur is very imperfectly equipped. One is quite at a loss to understand how an experimental agricultural station can carry out its objects even imperfectly without an analytical laboratory. To conduct the experiments with any degree of accuracy, an experimental farm should have an analytical laboratory attached to it, and the farm and the laboratory should be placed under one who is a practical agriculturist and a scientific agricultural chemist at the same time.

There also should be demonstration or exhibition farms in all important agricultural districts, so as to bring our knowledge of improved agriculture home to the cultivator A great link, however, is wanting in the North-Western Provinces between the central farm and the demonstration farms. This is a well-conducted model farm. Of late model farms have become very unpopular. Even men who have the agricultural welfare of the country near at heart look upon them as things which it is well to avoid. This no doubt is a reaction from the time when the general cry was "have as many model farms as possible, for the very regeneration of the country depends on them." That this again was a mistake none can doubt—an act of rashness on the part of men with the best of motives, but unfortunately not well-informed. To begin with, a model farm was really putting the cart before the horse. It was reversing the natural sequence. But in an attempt to improve the agriculture of a country like India, it is as impossible to do

without model farms as without experimental stations. In a more advanced country the duty of the Government might stop with making experiments, deducing general laws, and pointing out their bearing on practical agriculture. But this would not be sufficient in India. Here the risk of the first application of these laws to farm operations must be borne by the Government. Side by side with the experimental station, then, there must be a model farm. In the model farm the results of the field as well as the laboratory experiments should be tested by their application to actual agricultural practices. An experimental station with a well-equipped analytical laboratory attached to it for conducting agricultural experiments, both scientific and practical, a model farm where to apply the results of these experiments to actual agricultural operations, and small demonstration or exhibition farms to disseminate a knowledge of improved agriculture among the cultivators, are the three necessary steps on the way of endeavour to help the ryot in his calling. These three preceded by enquiring into existing agricultural practices make up one complete whole, and one is as indispensable as the other.

APPENDIX I.

Weekly rainfalls and number of wet days in the town of BURDWAN *during the last* 10 *years.*

Weeks.	1876.		1877.		1878.		1879.		1880.		1881.		1882.		1883.		1884.		1885.	
	Rainfall.	Wet day.	Rainfall.	Wet day.	Rainfall.	Wet day.	Rainfall.	Wet day.	Rainfall.	Wet day.	Rainfall.	Wet day.	Rainfall.	Wet day.	Rainfall.	Wet day.	Rainfall.	Wet day.	Rainfall.	Wet day.
1st week	.....	...	.....	...	0·16	2	.....	...	0·01	1	.....	...	.....	...	.....	...	.....	...	.....	...
2nd ,,	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	0·01	1	0·09	1	.....	...
3rd ,,	.....	...	0·26	2	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...
4th ,,	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...
5th ,,	.....	...	0·17	2	0·23	2	.....	...	.....	...	.....	...	.....	...	0·25	2	.....	..	.....	...
6th ,,	.....	...	1·76	3	0·01	1	.....	...	.....	...	.....	...	1·20	1	.....	...	0·15	2	0·51	2
7th ,,	.....	...	.....	...	.....	...	.....	...	1·41	1	.....	...	0·36	1	0·44	2	.....	...	0·28	2
8th ,,	0·44	1	.....	...	.....	...	1·16	2	1·13	3	0·01	1	0·56	2	.....	...	0·20	1	.....	...
9th ,,	2·00	2	.....	...	0·02	1	.....	...	0·07	1	.....	...	.....	...	0·75	2	.....	...	.....	...
10th ,,	.....	...	.....	...	.....	...	.....	...	.....	...	0·01	1	.....	...	5·17	4	.....	...	0·02	1
11th ,,	0·41	2	0·17	2	0·18	1	.....	...	.....	...	0·88	3	.....	...	0·42	3	0·02	1	0·04	1
12th ,,	.....	...	0·18	1	0·87	2	.....	...	.....	...	0·64	3	.....	...	.....	...	.....	...	.....	...
13th ,,	0·11	2	1·16	4	.....	...	.....	...	.....	...	0·63	2	0·81	1	.....	...	.....	...	.....	..
14th ,,	.....	...	0·82	3	0·07	1	.....	...	1·31	1	.....	...	0·02	1	.....	...	.....	...	.....	..
15th ,,	·27	2	1·22	3	2·21	2	.....	...	0·23	1	.....	...	0·16	1	.....	...	0·64	2	.....	...
16th ,,	·15	1	.....	...	1·19	2	.....	...	0·77	2	2·05	2	.....	...	.....	...	1·26	4	.....	...
17th ,,	...	...	.....	...	.....	...	0·12	1	0·01	1	.....	...	0·60	2	4·06	4	1·15	3	.....	...
18th ,,	0·18	1	0·02	1	3·76	5	0·31	1	0·82	2	0·09	1	1·15	2	3·88	4	3·01	5	0·83	3
19th ,,	.....	...	0·46	2	2·74	4	.....	...	0·26	2	1·92	3	2·06	3	0·09	1	0·86	1	0·49	3
20th ,,	0·54	4	0·89	2	2·16	4	0·25	1	1·60	6	1·23	3	.....	...	0·30	1	0·67	1	1·47	2
21st ,,	0·30	4	1·72	3	0·76	4	0·06	2	1·91	5	3·06	3	0·32	3	.....	...	0·10	2	.....	...
22nd ,,	0·73	4	2·03	3	1·80	2	0·25	2	0·68	3	1·11	4	1·55	3	2·70	2	2·44	3	0·06	1
23rd ,,	2·09	4	2·24	4	.....	...	0·53	3	2·95	4	4·22	6	1·08	5	2·43	2	0·37	2	0·30	1
24th ,,	1·13	2	.....	...	0·77	3	0·41	5	0·55	1	0·95	5	4·49	6	1·80	5	0·62	3	3·18	4
25th ,,	3·82	5	0·49	2	1·33	3	0·52	3	1·09	2	2·65	5	1·87	3	5·61	3	0·90	2	2·18	5
26th ,,	2·40	4	2·70	6	0·65	2	4·96	5	3·48	7	1·12	4	1·76	4	2·20	5	0·38	3	3·18	7
27th ,,	2·24	4	0·87	3	0·70	2	0·85	6	2·41	7	2·66	5	4·82	4	0·32	5	1·48	5	0·91	3
28th ,,	1·46	6	1·58	6	1·93	4	1·87	5	4·86	7	2·60	7	1·88	5	2·04	6	2·41	4	8·04	7
29th ,,	2·33	7	1·20	4	1·42	1	3·31	6	0·41	6	0·52	4	2·20	6	14·02	7	1·75	4	0·50	3
30th ,,	2·52	5	3·98	4	4·29	5	2·22	4	1·61	5	4·21	4	1·62	5	0·82	6	1·20	3	0·77	3
31st ,,	6·10	7	1·98	4	2·60	6	0·21	3	4·18	7	1·87	4	0·42	2	6·58	7	2·47	4	1·20	4
32nd ,,	0·73	5	6·46	6	3·21	7	3·49	7	4·04	6	5·31	4	1·12	5	4·02	6	3·69	5	3·31	7
33rd ,,	2·22	6	1·70	4	7·97	7	1·06	6	3·55	7	1·66	3	2·94	6	5·13	7	0·99	6	1·56	7
34th ,,	1·07	5	7·62	6	0·86	4	1·22	6	2·90	6	11·49	7	2·56	4	1·04	3	1·37	5	5·59	6
35th ,,	6·66	2	3·19	5	2·54	4	1·48	6	2·65	6	3·90	4	0·04	1	1·95	7	0·87	6	2·54	7
36th ,,	0·77	5	.....	...	1·10	6	3·28	6	4·93	7	0·29	1	0·44	3	0·75	6	1·54	4	1·78	4
37th ,,	1·83	5	1·71	4	3·32	5	3·83	6	1·03	4	3·40	5	0·76	5	0·33	4	0·28	3	1·32	6
38th ,,	1·52	4	.....	...	0·69	3	1·14	6	0·24	3	3·29	5	0·44	2	.....	...	2·86	6	5·93	4
39th ,,	2·07	5	0·04	1	5·22	6	3·26	4	1·11	4	0·75	2	2·00	3	0·40	2	1·37	4	1·86	3
40th ,,	...	..	0·19	2	1·00	2	1·21	3	1·64	1	0·35	4	1·35	2	.....	...	.....	...	0·41	3
41st ,,	2·76	4	1·88	3	0·15	1	0·38	4	0·12	1	3·26	2	0·50	2	0·68	2	.....	...	.....	..
42nd ,,	0·24	1	0·32	1	1·38	2	2·67	4	0·75	3	.....	...	4·84	3	0·02	1	1·71	5	0·05	1
43rd ,,	.....	...	.....	...	.....	...	.....	...	2·28	1	.....	...	.....	...	.....	...	0·05	1	1·78	4
44th ,,	.....	...	.....	...	1·92	2	.....	...	0·80	2	.....	...	3·35	3	.....	...	.....	...	.....	...
45th ,,	.....	...	.....	...	0·63	3	.....	...	0·03	2	.....	...	.....	...	.....	...	.....	...	0·08	1
46th ,,	.....	...	.....	...	.....	...	.....	...	0·03	1	.....	...	.....	...	.....	...	.....	...	.....	...
47th ,,	0·23	1	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...
48th ,,	0·01	1	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...
49th ,,	.....	...	.....	...	.....	...	.....	...	.....	..	.....	...	.....	...	1·18	2	.....	...	.....	...
50th ,,	...	...	0·08	2	0·04	1	0·15	2	.....	...	.....	...	.....	...	.....	...	.....	...	.....	...
51st ,,	...	..	.....		0·18	2	.....	...	0·02	1	.....	...	.....	...	.....	...	.....	...	0·05	2
52nd ,,	.....	...	.....	...	.....	...	.....	...	...	...	...	...	.....	...	.....	...	.....	...	0·87	1

APPENDIX II.

THE RURAL ECONOMY OF BURDWAN.

MOYNA.

LIKE most villages in the Burdwan district, Moyna is a mixed village of agriculturists and men belonging to other professions.

Position.

It is about seven miles from the Memary station on the East Indian Railway line, and is a little more than a mile from the metalled leading road from that station to Chakdighi, a considerable village in the Burdwan district. The Eden Canal passes within two miles of the village, but the regulator by which water is obtained for irrigating a portion of the village lands is five miles off.

Soil.

The soil of most parts of the village is a peculiar sandy loam of a greyish-white colour, in which the plant called *gholghasa* grows very luxuriantly, and is a troublesome weed to eradicate. Similar soil is found occupying limited areas all over the division and in the Tipperah district, and, so far as my observation goes, it is always characterised by the same plant. In appearance as well as in texture it is very different from laterite clay and red sands prevailing in the western and central parts of the division.

Land tenures.

The village consists of four patties, viz, Sripur, Dattapur, Jagadispur, and Mansingpur, of which the first belongs to a zemindar of British Chandernagor, and the rest which belongs to the Burdwan Raja, is let in patni to the Babus of Bhastara. Nearly a fourth of the village forms rent-free tenures (lakhiraj.) The ryots have for the most part mokurrari rights, and are not liable to eviction or enhancement of their rents. The landlords in consequence are quite indifferent to the improvement of the village.

Area.

The village and the land pertaining to it cover about 1,532 bighas, divided thus :—

	Bighas.
1. (a) Bastu land	70
(b) Udbastu land	60
2. Arable land	1,202
3. Uncultivated and waste lands	200
Total ...	1,532

The great extent of the udbastu land or forsaken village sites as compared with bastu lands shows that it is due to the great mortality which was caused by the epidemic fevers during the years 1869—1883.

The arable land was distributed under the different crops in 1885 thus :—

	Bighas.
(1) Paddy	1,048
(2) Pulses	145
(3) Sugarcane	1
(4) Potatoes	9
(5) Onions	¾
(6) Barley	¾

* In ordinary years 8 to 9 bighas are under sugarcane. The figure given here is so low owing to the drought of the summer of 85.

Population.

The total population of the village consists of 564 souls distributed thus :—

1. Age and sex—(1) Adult—(a) male	188
(b) female	210
(2) Children	166

2. Caste, &c.—

	Male.	Female.	Children.	Total.
1 Brahmin	6	14	6	26
2 Kaestha	19	30	28	77
3 Sadgop	33	48	38	119
4 Tamli	7	8	5	20
5 Kamar	2	4	3	9
6 Napit	5	2	1	8
7 Goala	36	36	20	92
8 Baistab	7	4	3	14
9 Jugi	3	1	6	10
10 Bagdi	9	10	7	26
11 Dule	24	17	16	57
12 Hadi	11	8	10	29
13 Dhoba	4	5	6	15
14 Chandal	7	5	9	21
15 Moyra	0	2	0	2
16 Sankari	3	4	0	7
17 Kansari	3	2	2	7
18 Mahomedan	5	6	2	13

3. Professions—

	Male.
Servants (superior)	12
Tradesmen	16
Cultivators	75 } = 106
Agricultural labourers	31 }
Others	54

Cattle, &c.

1. Working bullocks—

(1) Plough	135
(2) Cart	2

2. Milking cows and calves—

(1) Cows	217
(2) Calves	217

3. Sheep and goats—

(1) Sheep	20
(2) Goats	83

Ploughs.

There are 65 ploughs at work in the village.

Implements.

The implements used by the cultivators—

Names.	Prices. Rs.	A.	P.
Plough	2	0	0
Yoke	0	6	0
Kodal	1	0	0
Sickle	0	4	0
Phor	0	1	0
Harrow	1	0	0
Langli (small plough)	0	8	0
Simni	0	2	0
Donga	5	0	0
Ladder	0	2	0
Palan (bullock saddle)	2	0	0
Campa (sunn strap to bind sheaves with)...	1	0	0
Goon (a sunn bag)	1	0	0

Means of irrigation.

About 100 bighas are irrigated from the Eden Canal. There are about 30 tanks for irrigation purposes in the village. These have all been filled up with silt and overgrown with weeds. The oldest men in the village cannot say when these tanks were dug, and whether they were ever repaired. Most of the village lands are dependent on rain water. There are no wells in the village.

The water-lifts used are sunni and donga.

Wages.

The agricultural servants are paid partly in cash and partly by food and cloth—

	Rs.	A.	P.
Cash	2	8	0
Food and cloth	3	12	0
Total ...	6	4	0

The amount paid in cash is sometimes a little less than what has been put down above, but the average total monthly salary will not be less than Rs. 6.

Day-labourers ordinarily get 3 annas per head. This amount is nearly doubled during the harvest time. Carpenters and blacksmiths get about 8 annas a day each.

The wages are increasing, and during the last 10 years have increased 30 to 40 per cent.

For repairing any agricultural implements, the ploughs, sickle, kodali, &c., the village blacksmith, who also does the work of a carpenter, is not paid in cash, but gets as many as 12 aris (48 seers) of paddy for each. Payment is made in cash when a new implement is made.

Markets.

There is a hât held twice a week at a place between the villages of Moyna and Nabagram. The things generally sold are vegetables, pulses, and oil-seeds, cloths, iron implements, and basins, cheap silver and gold ornaments, penknives, pencils, papers, &c. There are two shops in the village and two more in the neighbouring village of Nabagram. The things kept in those shops are cloths, rice, dal, salt, spices, sweetmeats, and household brass and kansa utensils.

Means of communication, &c.

The village is connected with the Memary-Chakdighi road by a kacha road. Carts and bullocks are generally used to carry things from village to village.

Freight—

(1) By cart, 3 pies per maund per mile.
(2) By bullocks, 9 pies per maund per mile.

Bullocks are used where there are no cart roads.

One cart can carry 16 maunds.

One bullock can carry 2½ maunds.

Prices of food-grains.

The ryots generally sell the produce of their fields as soon as the harvest time is over. They sell mostly to grain dealers. The difference between the rates at which the cultivators sell their grains at the harvest time and the prices at which these articles are sold afterwards is not much in ordinary years, but it is considerable in years of famines or when there may be a great demand in foreign markets:—

	1885.		1886.
	Harvest time.	Afterwards.	Harvest time.
Paddy	40 seers.	34 seers.	48 seers a rupee.
Kalai	16 „	14 „	21 „ „
Mug	10 „	8 „	10 „ „
Matar	32 „	30 „	32 „ „
Gram	24 „	20 „	24 „ „
Potatoes	Re. 1-2 per maund,	Rs. 2-8 per maund	Re 1-4 a maund.

What the village got from other villages or foreign countries in 1885—

Article.	Quantity.	Money value. Rs.	A.	P.
Salt	76 maunds.	190	0	0
Tobacco	24 „	108	0	0
Treacle	24 „	60	0	0
Gur	36 „	144	0	0
Oilcake	125 „	166	4	0
Cocoanut oil	6 „	78	0	0
Mustard oil	36 „	342	0	0
Spices	1½ „	15	0	0
Wheat flour	3 „	24	0	0
Ghee	1½ „	45	0	0
Rope	2 „	20	0	0
Cloth	..... „	600	0	0
Paddy	500 „	500	0	0
Hide salt	40 „	50	0	0
Kerosine oil	3 „	13	8	0
Total ...		2,355	12	0

Exports in 1885 :—

Article.	Quantity.	Money value. Rs.	A.	P.
Paddy	600 maunds	600	0	0
Pulses	70 „	140	0	0
Potatoes	100 „	125	0	0
Rice	200 „	500	0	0
Milk	100 „	225	0	0
Curd	60 „	120	0	0
Chhana	250 „	1,250	0	0
	Total ...	2,960	0	0
Saving of villagers engaged variously elsewhere, brought to the village (near guess)		1,344	0	0
	Total ...	4,304	0	0

The accumulation of wealth per head in the village is Rs. 3-7-3 a year. Most of the amount is absorbed by the mahajans and Government servants. There are four mahajans in the village.

Mahajans.

They lend money as well as paddy. The usual rate of interest is 1½ pice per rupee per mensem, *i.e.*, Rs. 27-6 per cent. per annum. Paddy is lent throughout the year, and is got back after the harvest time with an interest of 25 per cent. The cultivators are mostly indebted to the mahajans. The debt of each joint family varies from Rs. 10 to Rs. 60.

Holding.

The average size of the ryots' holding = 17 bighas.

Rents.

1st class Rs. 4 per bigha.
2nd „ „ 2-8 „
3rd „ „ 2 „
4th „ „ 1-4 „

Representing the total arable land by 16 annas, there are in the village—

1st class land	1 anna.
2nd „ „	6 annas.
3rd „ „	4 „
4th „ „	5 „

The average rental per bigha is therefore Rs. 2 and five pice.

Manures.

The manures generally used are—

Cowdung.
Cowdung ashes.
Sweepings of cowsheds. } The three put in the same heap.
Oilcake.
Hide salt.

There are about 30 to 40 bighas of common grazing grounds situated in three different places. For this land the ryots pay nothing to the landlords. Paddy straw is used as fodder and for thatching huts.

Grazing grounds.

There is a pathsala in the village, and a school teaching up to the upper primary standard in the neighbouring village of Nabagram. About 18 boys attend the pathsala, of whom 12 are children of cultivators. The 4 boys of the village attending the school at Nabagram all belong to the cultivating class. The children of the well-to-do villagers receive their education in Burdwan and other towns.

Education.

Jagat Chandra Ghose may be taken to represent a well-to-do ryot in the Burdwan district. His family consists of adult males three, adult females three, and one child.

His wealth—

	Rs.	A.	P.		Rs	A.	P.
4 Cottages	92	0	0	3 Phors	0	3	0
3 Bullocks	60	0	0	1 Ladder	0	2	0
3 Cows	28	0	0	2 Palan	5	0	0
3 Calves	6	0	0	2 Kampa	2	8	0
2 Ploughs	3	0	0	Plates and basins	25	0	0
1 Yoke	0	8	0	Ornaments	250	0	0
3 Kodalis	3	12	0				
3 Small kodalis	1	8	0	Total ...	478	5	0
3 Sickles	0	12	0				

His debts ... ... Rs. 250 0 0

(This money has been borrowed at the time of his brother's marriage. Interest Rs. 18-12 per cent. per annum).

His yearly income—

The size of his holding is 15 bighas. He also cultivates 12 bighas of land belonging to another person, the produce being equally divided between him and the owner of the land.

Money value of produce of his holding in 1885 :—

	Rs.	A.	P.
Paddy 200 maunds	181	13	0
Potatoes 36 „	43	2	0
Kalai 10 „	24	0	0
Total ...	248	15	0

[*N. B.*—On the average about 1½ seers of milk is obtained daily. This is not sold, but kept for family consumption.]

His ordinary expenses—

Daily—	Rs.	A.	P.
Rice 5½ seers	0	5	3
Dal 1½ powas	0	0	6
Salt	0	0	3
Oil	0	5	7½
Vegetables	0	0	6
Spices	0	0	1½
Tobacco	0	0	3
Betel, &c.	0	0	3
Oil-cake (for the bullocks and cows)	0	0	6
Total ...	0	8	3

Yearly—	Rs.	A.	P.
Food and oil-cake	198	3	3
Rent	30	1	6
Cloth	19	0	0
Total ...	242	4	9

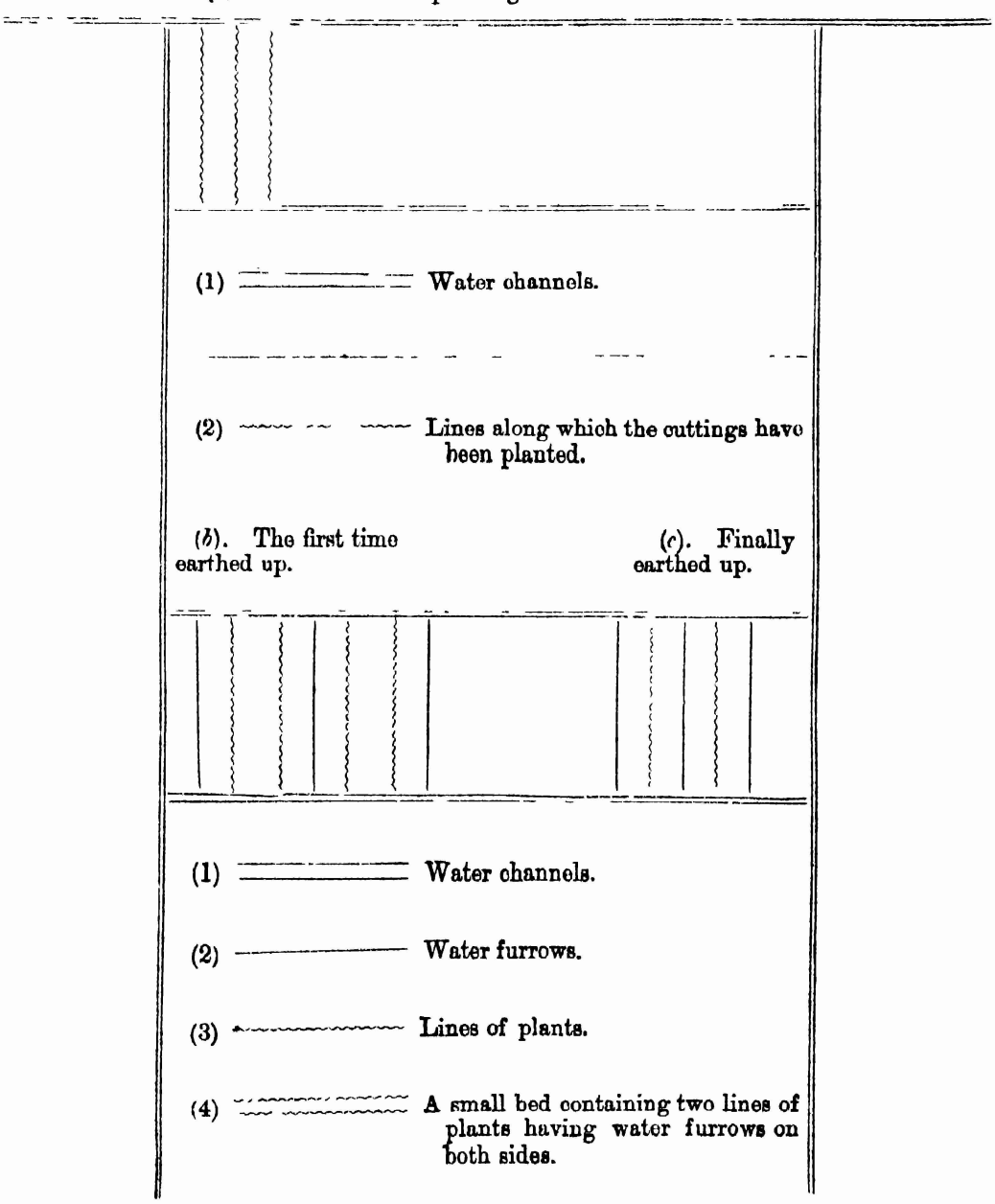
APPENDIX III.

Plan No 1.

Plan of a Sugarcane field.

Up.

(*a*). At the time of planting.



Down.

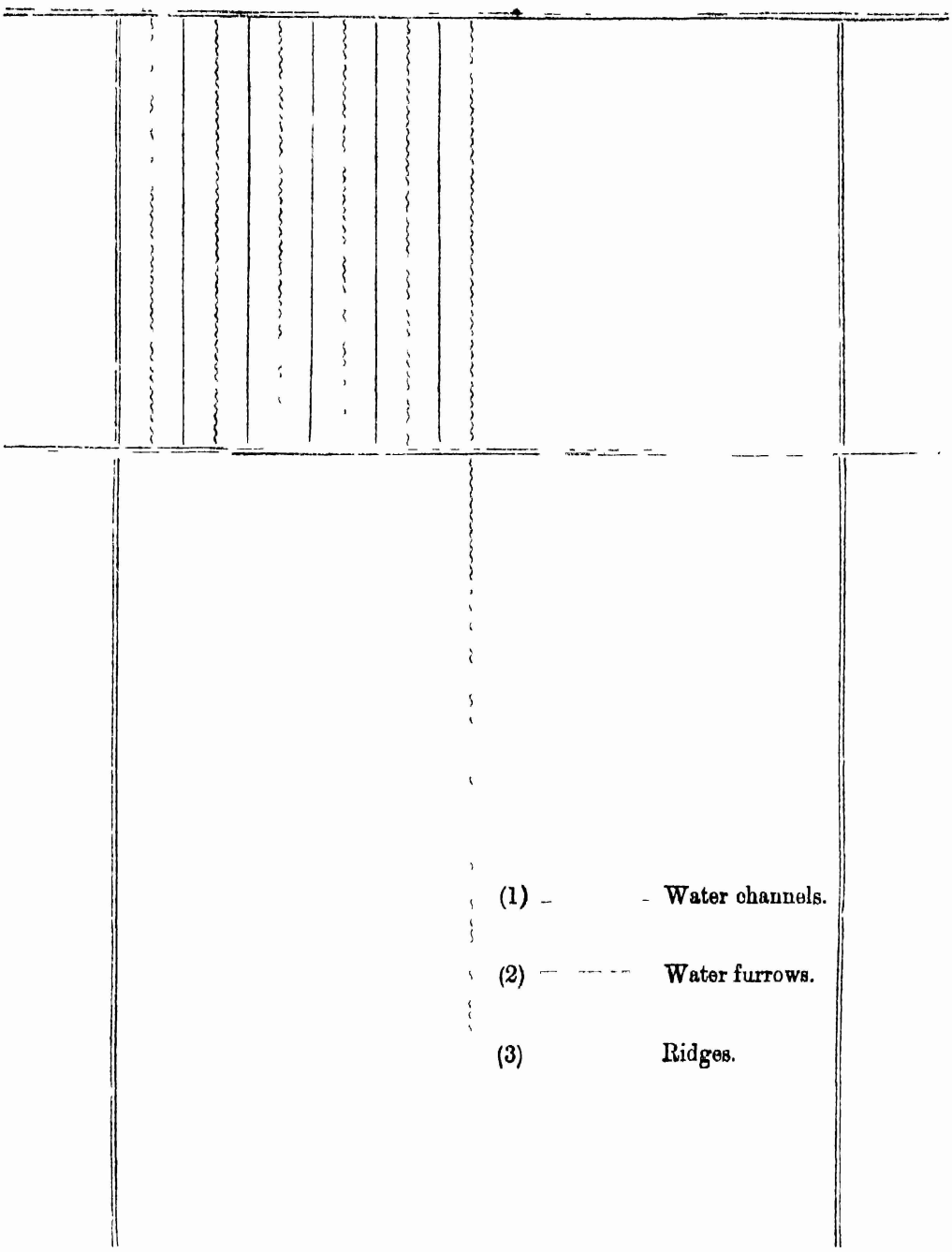
Scale, 1 *inch* = 8 *feet*.

APPENDIX III.

Plan No. 2.

Plan of a Small Onion or Garlic field.

Up



Down.

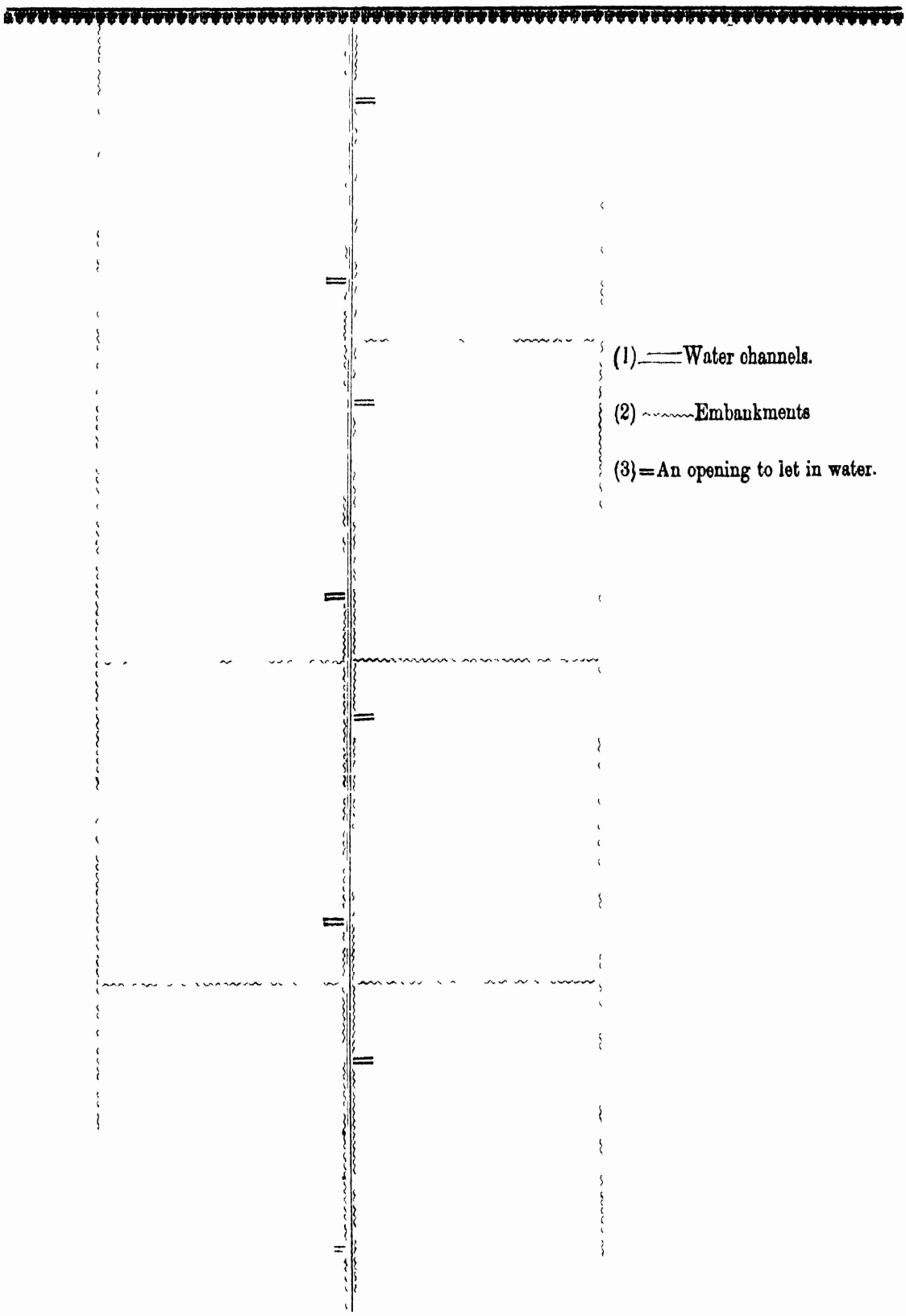
Scale, 1 *inch* = 3 *feet.*

APPENDIX III.

Plan No. 3.

Plan of a Large Onion Field.

Up.



Down.

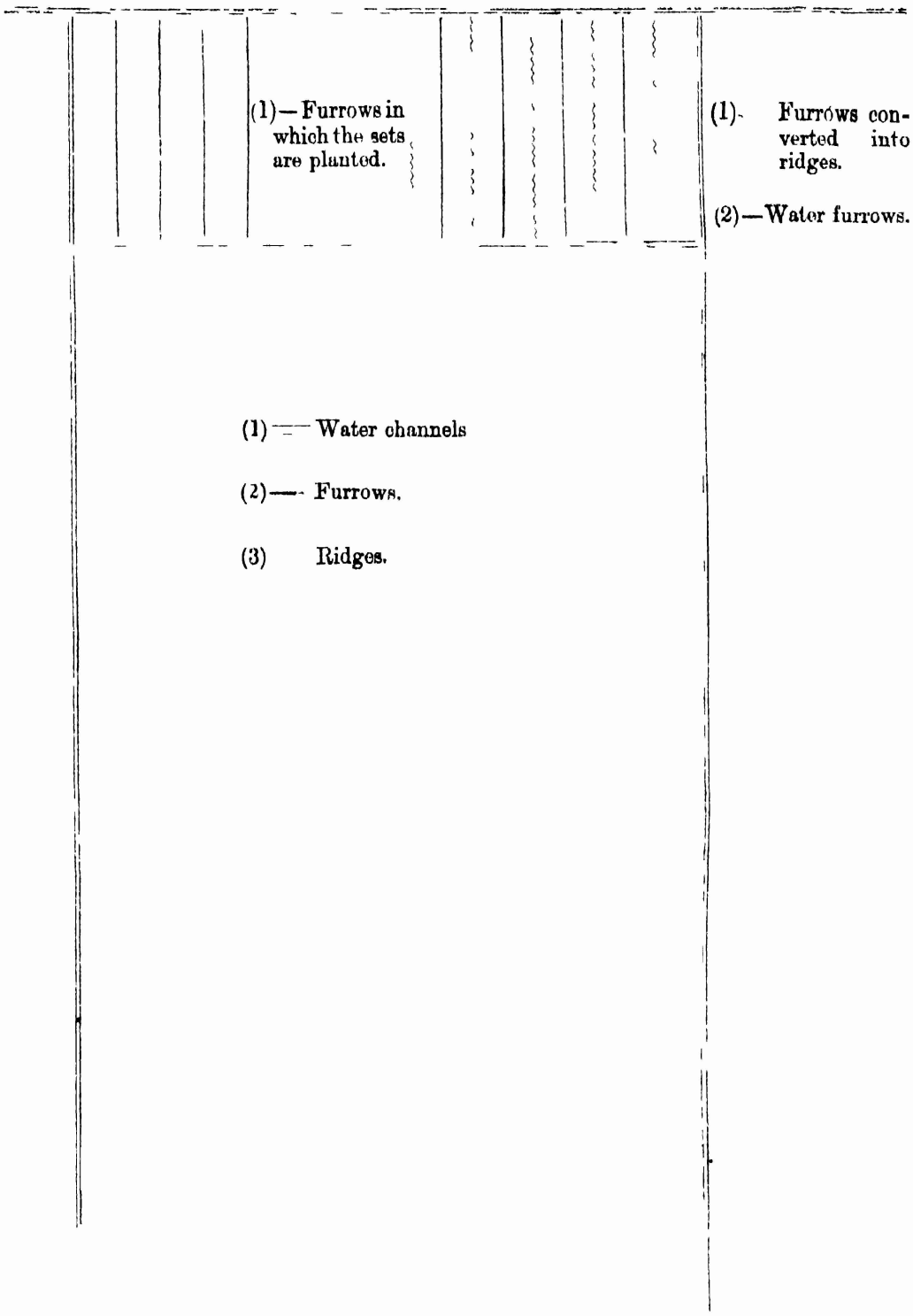
Scale, 1 inch = 2 feet.

APPENDIX III.

Plan No. 4.

Plan of a Kachu Field.

Up.



Down.

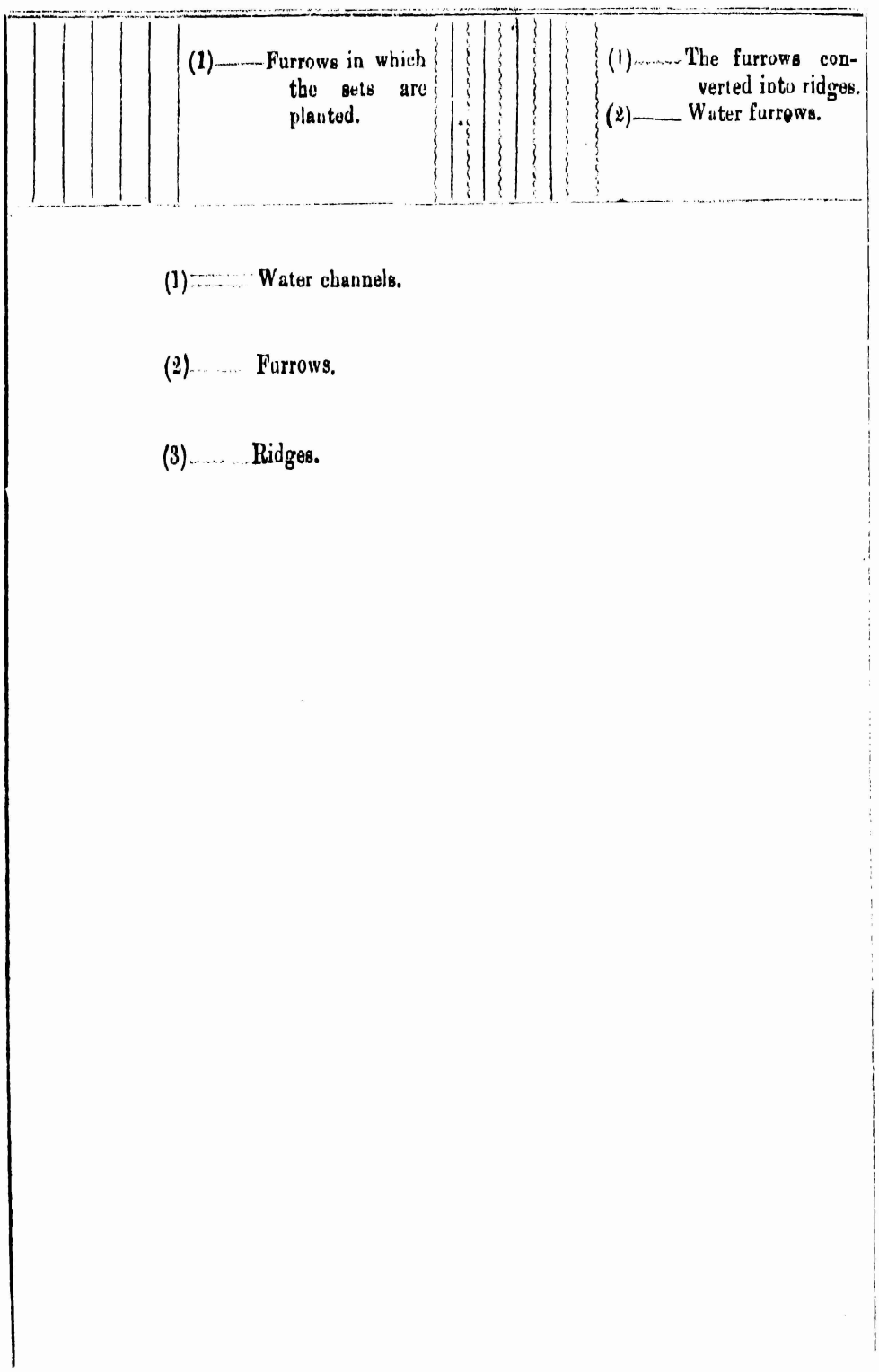
Scale, 1 *inch* = 8 *feet*.

APPENDIX III.

Plan No. 5.

Plan of a Ginger field.

Up.



Down.

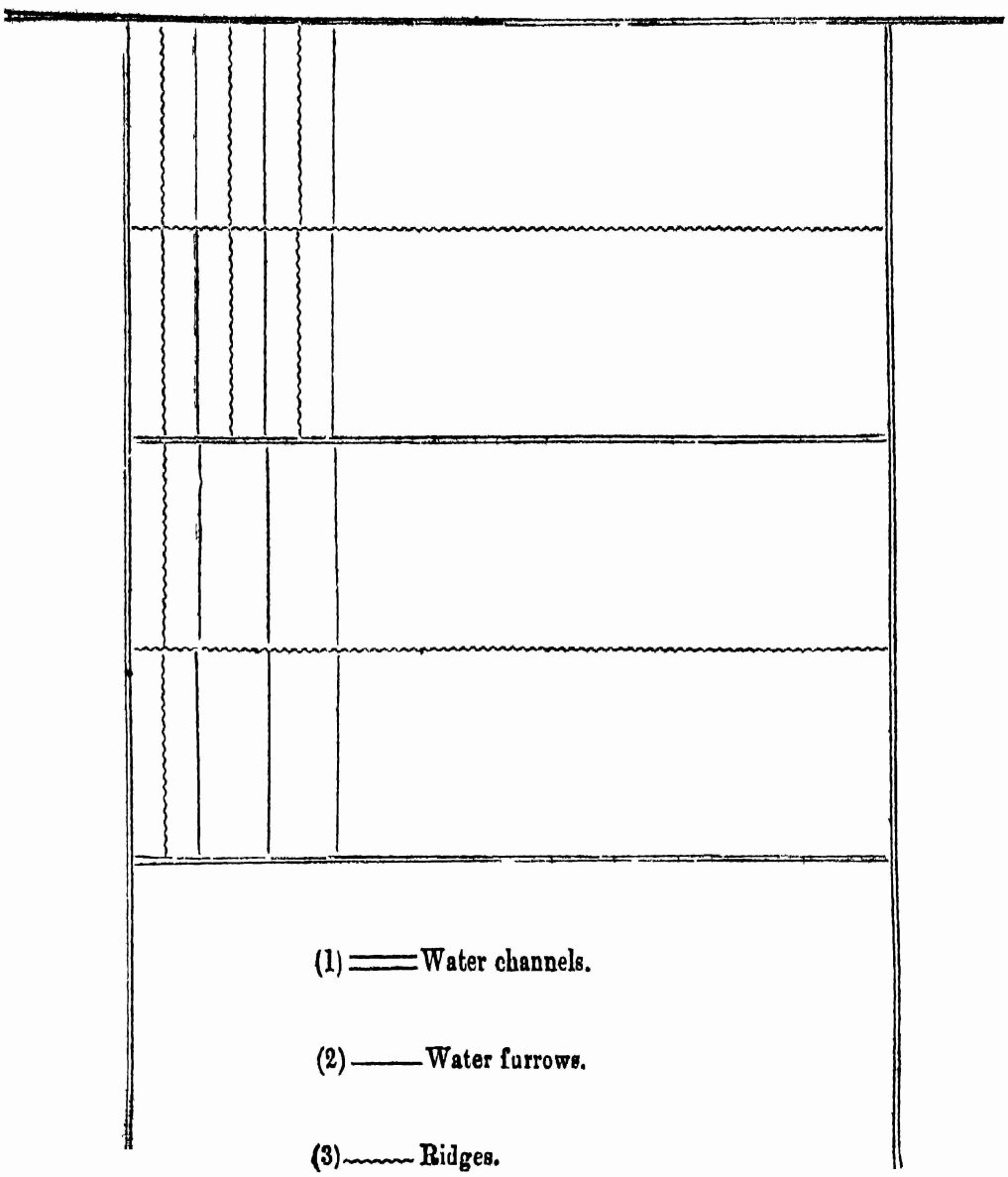
Scale, 1 *inch* = 8 *feet.*

APPENDIX III.

Plan No. 6.

Plan of a Potato field (when earthed up).

Up.



Down.

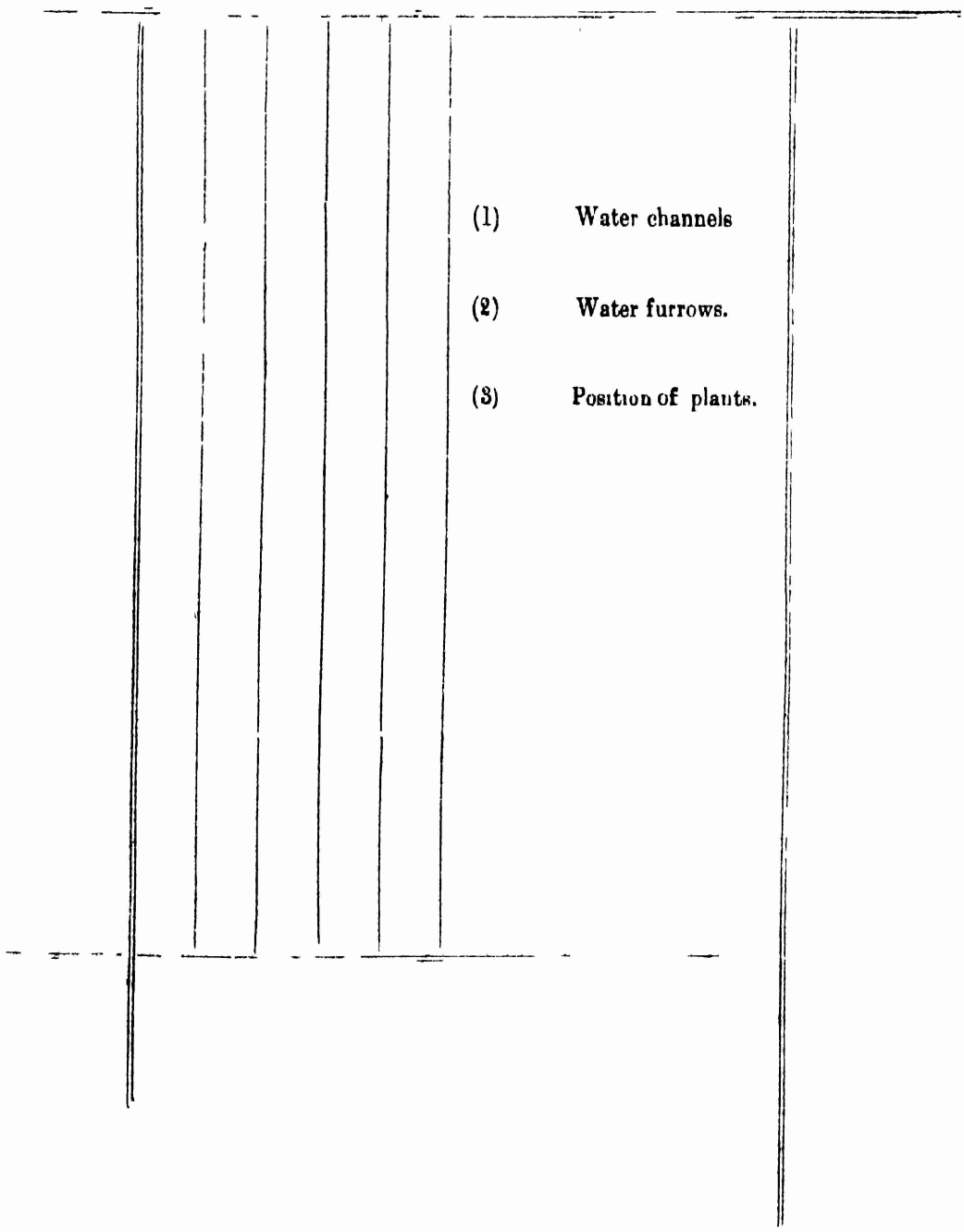
Scale, 1 *inch* = 8 *feet.*

APPENDIX III.

PLAN No. 7.

Plan of a Begun field, &c

Up.



Down.

Scale, 1 *inch* = 8 *feet*.

APPENDIX IV.

Measures and Weights, &c.

Straw measure.

4 Atis (sheaves)	...	1 Ganda.
20 Gandas	...	1 Pan.
16 Pans	...	1 Kahan.

Corn measure.

4 Seers	...	1 Ari.
20 Aris	...	1 Bish.
16 Bishes	...	1 Kahan.

Another form.

4 Seers	...	1 Ari.
10 Aris	...	1 Sali.
16 Salis	...	1 Kahan.

Weights.

4 Chataks	...	1 Powa.
4 Powas	...	1 Seer.
40 Seers	...	1 Maund.
1 Maund	...	82 lbs.

Coins.

4 Pice or 12 pies	...	1 Anna.
16 Annas	...	1 Rupee.

Lengths.

2 Haths (cubits)	...	1 Yard = 36 inches.

Surfaces

5 Square cubits	...	1 Kancha.
4 Kanchas	...	1 Chatak.
4 Chataks	...	1 Powa.
4 Powas	...	1 Cottah.
20 Cottahs	...	1 Bigha.
1 Bigha	...	80 cubits × 80 cubits.
	=	⅓ Acre nearly.

Bengali Months.

Bengali Months.			Corresponding English Months.
Baisakh	...	...	From about 15th April to 15th May.
Jaistya	...	...	„ „ 15th May to 15th June.
Ashar	...	...	„ „ 15th June to 15th July.
Sravan	...	...	„ „ 15th July to 15th August.
Bhadra	...	...	„ „ 15th August to 15th September.
Aswin	...	...	„ „ 15th September to 15th October.
Kartik	...	...	„ „ 15th October to 15th November.
Agrahayan	...	...	„ „ 15th November to 15th December.
Pous	...	...	„ „ 15th December to 15th January.
Magh	...	...	„ „ 15th January to 15th February.
Falgun	...	...	„ „ 15th February to 15th March.
Chaitra	...	...	„ „ 15th March to 15th April.

APPENDIX III.

Extract from report by Baboo Nundjee, Deputy Collector in charge Mozufferpore Survey and Settlement, giving comparison of rates now found to be prevailing with rates prevailing when settlements and batwarras were made, for certain villages for which data for comparison are available.

INFORMATION regarding 10 villages has been compiled from the settlement and batwarra papers, and is shown in the comparative statement annexed regarding rates and rents before batwarra and after.

2. In comparing rentals according to revenue settlement and batwarra papers and present settlement, an explanation of increase or decrease has been given in the notes which I have made on each of the villages in which the amount of the Government revenue with the rentals has also been compared.

3. It will be seen from the notes that the rents have been enhanced enormously since the Government revenue settlement, and I need hardly add that the enhancements were arbitrary.

The following is a comparative statement of the increase in rent rates since the permanent settlement :—

Serial number	Name of village	Average rate according to settlement or batwarra papers. Year	Average rate per bigha.	Average rate per bigha in 1886.	Increase in rate-rents	Remarks by Baboo Nundjee, Assistant Settlement Officer in Mozufferpore
			Rs. A. P	Rs A P		
1	Mirzapur	1848	1 8 4	6 0 0	290 per cent. ..	While the area of the nagdi land has decreased by 75 per cent. owing to its being taken away from ryots and converted into zeraat by the zemindars, the gross rental has increased by 128 per cent since 1848 During the period of 26 years since 1861, the rental has been enhanced by 138 per cent
2	Bishunpur Sumeri ..	1841	1 1 4	2 1 6	94 ..	The average rate per bigha on the nagdi area under cultivation was Re 1-1-4 in 1841, while the average rate per bigha of the area now under cultivation is Rs 2 1-6 The rates in 1841 varied from a maximum of Rs 2 to a minimum of 8 annas. The present rates vary from Rs 4-8 to Rs 2.
3	Madhuban	1841	1 2 5	2 11 4	134 ..	.. .. ..
4	Chak Ahmad ..	1840	1 0 2	2 9 1	148	While the area of rayati land has decreased by 29 per cent owing to its conversion into zeraat and bhach, the mofussil rental has been increased by 93 per cent since 1840 Rates in 1840 varied from a maximum of Rs 2 to a minimum of 2 annas, the present rates vary from Rs. 5 to Rs. 2-8 per bigha
5	Pokhraira Qasim	1840	1 6 9	4 11 1	229	The area of the nagdi land has increased by 68 per cent. since 1840, while the gross rental has increased by 449 per cent The average rate per bigha in 1840 was Rs. 1-6-9, the average rate per bigha now is Rs. 4-11-1, or three times the rate of 1840.
6	Asapur Bhawani	1834	2 1 11	4 15 2	133	The average rate per bigha under cultivation in 1834 was Rs. 2-1-11, while the average rate per bigha now under cultivation is Rs. 4 15-2, or more than double the average rate in 1834 Since batwarra in 1859, considerable area of rayati land has been converted into zeraat.
7	Chhitrauli	1842	1 7 0	5 1 2	253 ..	The average rate per bigha according to the settlement papers in 1842 was Re 1-7, the average rate per bigha now is Rs 5-1-2 While the area of the rayati land has, during a period of 45 years, increased by 11 per cent, the mofussil rental has increased by 370 per cent. Rates according to settlement varied from a maximum of Rs 4-4 to a minimum of 8 annas. The rates now vary from a maximum of Rs 13 to a minimum of Re. 1-2.
8	Chak Shah	1834	1 5 3	2 12 8	23 .. .	The area of the rayati land is now almost the same as in 1834, while the gross rental has increased by 140 per cent. The village has not been partitioned hence the enhancement is so moderate.
9	Afzal Chak	1859	1 5 10	2 11 5	123	The average rate of rent fixed at the time of settlement of Government revenue has been more than double, but nearly all the rayati land has been converted into zeraat.
10	Mian Pakri . . .	1838	1 2 7	3 [illegible] 7	202	While the area of the rayati land is nearly the same now as in 1838, the gross rental has increased by 211 per cent
	Kamtaul Mazaffra . .	1840	1 14 0	6 3 3	230	The average rate of rent at the time of the settlement in 1840 was Re. 1-14-0 The average rate of rayati land under cultivation is now Rs. 6-3-3, or four times the rate of 1840 Rent was enhanced in 1876 and again in 1884.
12	Nandlalpur Luki ..	1845	1 7 3	3 [illegible] 8	122 ..	The average rate has been doubled during the period of 34 years, while the area of rayati land has been materially diminished.

4. It is a known fact that batwara gives an excellent opportunity to the zemindars in this part of the country to enhance rents as much as possible, and the raiyats labour under a wrong impression that the law entitles them (zemindars) to such enhancements after partition. In batwara proceedings the actual rent payable by a raiyat for each plot or field is not ascertained; and as the holding of the raiyat is split up and allotted to different patties, he is obliged to enter into new arrangements with the different maliks who,

as might be expected, do not fail to take full advantage of the opportunity then afforded to them to enhance the rents. In some cases the raiyat is obliged to relinquish the lands falling into the patties of petty shareholders, when he finds their demand for enhancement of rent too heavy for him. The lands thus relinquished are brought into zeraat by the shareholders, and this, I believe, accounts for the existence of large area of zeraat in almost all the batwara villages at the present time.

5. In the absence of any record of rights and village accounts the raiyats are helpless. The majority of them cannot contest enhancements in court, as they have no satisfactory evidence to produce. Besides, they cannot afford to meet the cost of such litigation with their landlords. They are therefore obliged to throw themselves on the mercy of their landlords and to agree to the terms proposed by them.

(Sd.) NUNDJEE,

Assistant Settlement Officer, in charge.

APPENDIX IV.

Names of Native Gentlemen selected to hold the scholarships of the Royal Agricultural College, Cirencester, by the Government of Bengal.

Names.	When sent.	Remarks.
Babu Ambica Charan Sen ...	1880	Returned to India. Employed by the Government of Bengal.
Syad Sakhawat Hossein ...		
Babu Grish Chandra Basu ...	1882	Returned to India. Editor, *Indian Agricultural Gazette.*
,, Byomkesh Chakravarti ...		Returned to India.
,, Atul Krishna Roy ...	1883	Completed College course and returned to India Employed as Professor in the Education Department
,, Bhopal Chandra Basu ...		Completed course, but granted an extension to study continental agriculture.
,, Nritya Gopal Mukherji ...	1884	Still studying at Cirencester.
,, Dwijendra Lal Roy ...		Ditto ditto.
,, N. N. Banerjea ...	1885	Ditto ditto.
,, Debendra Nath Bhuttacharjya, M.A.	1886	Studying at Cirencester.
,, Dwija Das Dutta, M.A. ...		Ditto ditto.

R. D'R. & others—Reg. No. 11788J—228—25-12-86.